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## Article

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## Article

# The Effects of Inequality on the Substitution of Essential Goods for Tobacco Smoking in South Africa

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**Abstract:** Tobacco consumption contributes to a substantial amount of household expenditures, which might lead to decreased spending on other essentials. This study examines household head tobacco expenditures in various inequality settings. In this study, we investigated the impact of gender, race, and educational inequality and the substitution effect of tobacco expenditure on essentials such as children's education and household food. We looked at how much of the resources household heads spend on tobacco in different inequality settings that replace households' essentials. The panel setting of the National Income Dynamics Study (NIDS), South Africa's first nationally representative household panel survey, is used as a data collection source for this study. These are household surveys conducted by the Presidency's Office of Planning, Monitoring, and Evaluation. The panel data are subject to attrition in longitudinal research. We compared the conditional expenditure shares of various types of households using econometric models such as moment quantile regression. A negative and statistically significant estimated coefficient of tobacco expenditure and the coefficient of the interacted term (inequality and tobacco expenditure) demonstrated the substitution effect. The findings reveal that low-income households whose heads smoke tobacco invest less in their children's education, while well-educated heads of high-income households' place as much value on their children's education as they do on cigarette expenditure. The study also points out that the share of income spent on cigarettes by black household heads is negatively connected to their children's education across all quantiles compared to non-blacks. We conclude that low-income households are more likely to experience the substitution impact than high-income households. This study recommends, among other things, that low-income households should prioritize needs over non-essentials in order to maximize household satisfaction, and government should implement policies that will limit tobacco consumption expenditure.

**Keywords:** expenditure; essential and non-essential goods; household; inequality; substitution; tobacco



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## 1. Introduction

Smoking harms household welfare directly and indirectly when more household resources are channeled to tobacco expenditure (Shafey et al. 2009). Substituting essential goods for tobacco consumption expenditure can have a negative impact on households, particularly low-income earners. Some studies revealed that low-income families prefer tobacco over essential goods such as food, as evidenced by their low expenditure on food relative to tobacco (Shafey et al. 2009; Ahsan and Tobing 2008; Efroymsen et al. 2011). Statistics South Africa (2021) documented that roughly 23.6% of South African families suffered from food insecurity at some point in 2020, with 14.9% experiencing extremely low food security. Nutrition and food safety are interconnected components of public health that affect everyone. Therefore, poor nutrition can impede immunity, physical and mental growth, and productivity (World Health Organization (WHO) (2019); Alamgir et al. 2018). However, food availability and affordability are vital for the well-being of every individual (Enriquez and Archila-Godinez 2022; Sumaedi 2020; Pakravan-Charvadeh and Flora 2022).

Considering South Africa's high poverty rate, smoking might affect a family's ability to feed and educate their children due to its substitution effect. Education for all South Africans is important, as it is well known that the return on investment in education is the key factor in fighting against poverty, unemployment, and income inequality (Fiske and Ladd 2006). However, low household expenditure on education might indicate that people are not spending wisely on basic needs, which could signify market failure. According to Nord (2010) and Hulme (2009), insufficient allocation of household resources is sometimes exacerbated by a lack of money or inefficient distribution of household resources due to differences in taste and preference, as well as lifestyle choices. If funds used by smokers were channeled to feeding the malnourished, it would increase a country's well-being and decrease its debt (Baquilod et al. 2006; Kuperstein 2008).

The allocation of expenditures across different categories of commodities (e.g., food, shelter, apparel, transportation, education, and health care) is a fundamental issue in consumer research since it reflects lifestyle, taste, and preferences. Numerous studies have been conducted in this area (Wang et al. 2006; Baquilod et al. 2006; John 2008; Kuperstein 2008; John et al. 2011; Assadourian 2012; Adanlawo et al. 2021). Most of the studies have focused on the difference in earnings as a reduction factor for household essentials in South Africa (Pauw and Mncube 2007; Tregenna 2011). Other studies have looked at the crowding-out effect of tobacco on entire household expenditure, specifically focusing on differences between smokers and nonsmokers (Chelwa and Koch 2019). Most of these studies, to the best of our knowledge, have not taken inequality differences among household heads into account as a contributing factor to the decrease in household expenditure in South Africa. This gap necessitates our research to investigate intra-household inequality. Intra-household decision power is delineated primarily on the basis of association with the head of the household. Level of education, and whether a person contributes financially to the households, may inform who a person lives with and is linked to, but only weakly, the decision-making power in the household.

Some economic models convert these distributional effects into substitution effects, which relate essential expenditure shares to non-essential expenditures (Shafey et al. 2009; Ahsan and Tobing 2008; Efroymson et al. 2011). Few studies have focused on the psychological analysis of individual non-essential spending under various inequality conditions. Inequality, commonly defined as the state of not being equal, especially in status, rights, and opportunities, emerged from the apartheid regime (World Health Organization (WHO) (2019)). In this study, we use the term "non-essential goods" to refer to tobacco expenditure and "essential goods" to refer to household food and children's education expenditure. This study is concerned with these two distinct but related areas of research. Firstly, it analyzes the substitution effects of non-essential goods (smoking) on essential goods (household food and offspring education). The study also investigates whether the substitution of essential goods caused by an increase in tobacco expenditure differs due to the inequality challenges faced in South Africa. It is therefore possible that because of educational, racial, and gender disparities, the smoking behaviors of household heads may differ. We hypothesize that tobacco expenditure and household inequality may be a limiting factor for household expenditures such as food and children's education. The household head according to NIDS data is self-defined by the household and used simply as a construct to determine individuals' relational status to one another. In this particular study, "head of the household" refers to the household decision-makers. In the National Income Dynamics Study (NIDS), adults identified as the main decision-maker in the household on day-to-day household expenditures (e.g., groceries) and where children should go to school, among other things, are the household head. It is worth noting that the sample includes only household heads.

To address these challenges, in our empirical investigation, we rely on the moments quantile regression model proposed by Machado and Silva (2019). We further seek to extend on the work of Chelwa and Koch (2019) by analyzing the substitution effect of smoking on household expenditure, accounting for the racial, gender, and educational differences in

this argument, which were not included in their study. The rationale for this study was not a lack of studies examining the effect of tobacco on household expenditures, but rather the possibility that this relationship may differ from the one found in the literature due to differences in inequality.

## 2. Literature Review

Tobacco smoking has been alluded to as a lifestyle choice and a “temptation good” (Dasso Arana and Fernandez 2013), a phrase coined by Banerjee and Mullainathan (2010) to describe “goods that create positive utility solely for the individual who consumes them.” Tobacco is referred to as a “demerit good” by Musgrave (1959). The author explains that demerit goods are commodities that are demeritorious to either the user or to others, and that the government may intervene in regulating their use. With the description of tobacco by the abovementioned authors, it clearly indicates that the consumption of it might affect not only the users but also the entire household’s allocation of resources for essential commodities.

In addition to the obvious consequences of smoking on one’s health and being the third-leading cause of death and disability (Thamarangsi 2009), expenditure on non-essential items also has a substitution effect on the total expenditure on food and other essentials. It has also been observed in China that the poor who spend more on tobacco also spend more on the care of smoking problems (Liu et al. 2006; Yao et al. 2014) and less on essentials for daily living (Wang et al. 2006; Pu et al. 2008). Similar evidence has been reported, indicating that smoking has a significant trade-off on essentials, particularly in poor households. This evidence has also been found in studies from Africa, including those by Koch and Tshiswaka-Kashalala (2008); Chelwa and Van Walbeek (2014); and Chelwa and Koch (2019). We assert that consumption of tobacco by different classes of people may have different effects on individuals.

Inequality problems that are associated with living standards are crucial, as the process tends to be persistent and have intergenerational spillovers (Kivulu et al. 2005; Tregenna 2011). This indicates that inequality manifests itself through a skewed income distribution, unequal access to opportunities, and regional disparities. Low growth and rising unemployment have contributed to the persistence of inequality. This study focused on gender inequality, which refers to expenditure disparities that exist between individuals as a result of their gender. Furthermore, educational inequality refers to differing levels of educational attainment, education quality, and access to education among various population groups (Kivulu et al. 2005; ILO 2017; Chaka and Adanlawo 2023). Prior studies point out that there is a strong correlation between educational attainment and standards of living, which is widely recognized as a key factor in providing better employment and earnings opportunities (UNDP (United Nations Development Programme) (2003); Kivulu et al. 2005; Van der Berg et al. 2005; Ardington et al. 2009).

For this reason, inequality in education might be a driver of inequality in other spheres. Parents who were denied opportunities for education might have offspring who are also unable to access education (Kivulu et al. 2005). Inequality in education in South Africa persists across generations. Individuals who are better educated tend to obtain better jobs with higher earnings. This enables their children to be better educated as well. Children or offspring born into poor families may not have access to the same educational opportunities (Hoogeveen and Özler 2006).

Inequality in the sense that one does not have the same purchasing power as others can affect individual expenditures in many ways. First, it can reduce disposable income available for essential resources (through unemployment, gender, racial, and educational differences), which in turn leads to a smaller budget for essential consumption. Second, when using disposable income for non-essential goods, for example, consumption of tobacco may vary due to different inequality conditions, which again leads to less money spent on essential household goods. We hypothesize that tobacco consumption, in conjunction with other inequality differences, may contribute to resource substitution.

### 3. Methodology

This study used the first five waves of the NIDS (2008–2017), a household survey conducted by the Southern Africa Labour and Development Research Unit (SALDRU) at the University of Cape Town, to investigate how household heads distribute their money to different resources based on their tastes and preferences. This dataset is South Africa’s first nationally representative panel survey. It collects data on family and individual income, expenditure, and other socioeconomic and demographic aspects (for children and adults). All five waves of NIDS datasets are publicly accessible.

#### 3.1. Description of Variables

Table 1 presents information on specific variables employed in the empirical model. More importantly, it illustrates the evolution of two outcome variables from this study (total expenditure on household food and children’s education), obtained from the NIDS surveyors. Food spending was calculated by asking the respondent about the family’s total food expenditures in the previous 30 days. Children’s education expenditure was calculated by asking the respondent how much was spent on schooling (which includes tuition, uniforms, textbooks, and other school expenses) in the last 30 days. The explanatory variable is smoking expenditure, which is the number of cigarettes smoked in a day multiplied by 30 days to obtain the monthly expenditure by a household head. In addition to this study’s dependent and main explanatory variables, the researcher included some control variables that are important sociodemographic drivers of household expenditures.

**Table 1.** Summary definition of variables.

Variable	Description
Gender of household head	Dummy variable: 1 if head is male and 0 if female
Smoker variable	Indicates monthly smoking expenditure by the household head
Age of household head	Number of years
Education	Dummy variable: 1 if household head is educated and 0 if not educated
Marital status of household head	Dummy: 1 if household head is married, 0 otherwise
Residential area	Dummy variable: 1 if lives in urban and 0 otherwise
Eastern Cape	Household head in Eastern Cape
Northern Cape	Household head in Eastern Cape
Free State	Household head in Free State
KwaZulu-Natal	Household head in KwaZulu-Natal
North West	Household head in North West
Gauteng	Household head in Gauteng
Mpumalanga	Household head in Mpumalanga
Limpopo	Household head in Limpopo
Employment status of household head	Dummy variable: 1 if unemployed and 0 otherwise)
Offspring educational expenditure	Total household offspring education expenditure
Food Expenditure	Total household food expenditure
Race of household head	Dummy variable: 1 if black and 0, otherwise

Source: NIDS dataset.

#### 3.2. The Model

Methods of moments of quantile regression (MMQR) is the approach adopted, as it allows the use of methods that are only valid in the estimation of conditional means, while still providing information on how the regressors affect the entire conditional distribution. MMQR accounts for both endogeneity and heterogeneity and integrates the fixed effect by allowing the covariate to influence the conditional distribution of the interest variable (Machado and Silva 2019; Alhassan et al. 2020). The current study is significant, as it utilized all five waves of data sourced from the NIDS. The data are longitudinal, and the availability of such a dataset not only makes it possible to conduct a micro-type study within a panel framework but also allows researchers to analyze distributional effects of tobacco over time on the same individuals across waves.



As stated, MMQR identifies the conditional heterogeneous covariance effects of offspring education and total household food by permitting individual effects to have an impact on the whole distribution rather than the instability of means (Koenker 2004; Canay 2011). Quantile regression presupposes that relationships between independent and dependent variables are the same at all levels. In order to understand outcomes that are abnormally distributed and that have nonlinear associations with predictor factors, it is necessary to be able to grasp correlations between variables outside the data's mean using the quantile regression methodology (Le Cook and Manning 2013). In addition, the MMQR estimation technique is advantageous, as it controls endogenous explanatory variables and produces non-crossing estimates of the quantile's regression (Allard et al. 2018; Elbatanony et al. 2021).

The conditional quantiles  $Qy_{it}(s|\delta_i, x_{it}) = (x_{it}^s \beta_s)$ , where  $x_{it}$  represents the vector of the explanatory and control variables in Equation (1) below.

$$Y_{it} = \alpha_i + X_{it}'\beta + (\delta_i + Z_{it}'\gamma)U_{it} \quad (1)$$

where the probability,  $P\{\delta_i + Z_{it}'\gamma > 0\} = 1$ ,  $(\alpha, \beta', \delta, \gamma)'$  are parameters.  $(\alpha_i, \delta_i)$ ,  $i = 1, \dots, n$ , denotes the individual  $i$  fixed effects, and  $Z$  is a  $k$ -vector of identified elements of  $X$ , where transformations are differentiated with the factor  $l$  given by:

$$Z_l = Z_l(X), l = 1, \dots, k \quad (2)$$

$X_{it}$  is independent and identically distributed for any fixed  $i$  and is independent across time ( $t$ ).  $U_{it}$  is independent and identically distributed across individuals ( $i$ ) and through time ( $t$ ), and is orthogonal to  $X_{it}$  and normalized to satisfy the moments conditions according to Machado and Silva (2019), which do not imply strict exogeneity. The following is implied by Equation (2):

$$Q_Y(\tau|X_{it}) = \alpha_i + \delta_i q(\tau) X_{it}'\beta + Z_{it}'\gamma q(\tau) \quad (3)$$

In Equation (4),  $X_{it}'$  is a vector of independent variables.  $Q_y(\tau|X_{it})$  indicates the quantile distribution of the outcome variables,  $Y_{it}$  is the natural logarithm of total food consumed by the household or the household's education expenditure, which is conditional on the location of independent variable  $X_{it}$ ,  $\alpha_i(\tau) \equiv \alpha_i + \delta_i q(\tau)$  is the scalar coefficient, which indicates the quantile  $\tau$  fixed effects for individual  $i$ . The individual effect does not denote an intercept shift, unlike the usual least-squares fixed effects. They are time-invariant parameters whose heterogeneous impacts are allowed to differ across the quantiles of the conditional distribution of the endogenous variable  $Y$ . The  $q(\tau)$  indicates the  $\tau$ -th sample quantile, which is estimated by solving the following optimization problem.

$$\min_q \sum_i \sum_t p_t(R_{it} - (\delta_i + Z_{it}'\gamma)q) \quad (4)$$

where  $p_\tau(A) = (\tau - 1)A1\{A \leq 0\} + TA1\{A > 0\}$  denotes the check function.

The researchers also accounted for heteroscedasticity by converting food and education variables into their natural logarithms. Furthermore, the "robust" option on STATA was utilized to generate robust standard errors in both estimated models. A correlation matrix analysis was performed to identify possible indications of multicollinearity. The results indicate that the estimated models are free of multicollinearity issues. We do not control for fixed effect because we will lose significant information, such as our dummy (gender observation), which will vanish; however, we do control for time effect.

Likewise, the impact of rising tobacco expenditure in South Africa is estimated using Koenker's quantile analysis as used in Koenker's study (Koenker 2004). This paper analyzes at least three factors that, together with tobacco consumption by the household head, might affect household children's education and food, firstly by assuming that when tobacco consumption increases, it directly affects household resources or the income of

household heads who allocate funds to essential goods. Secondly, household food expenditure could decrease because of increased tobacco consumption by the household head. Finally, households may experience a negative change in household expenditure due to inequality differences such as the household head's level of education, gender, and racial differences in tobacco expenditure.

The empirical specification for estimated household food follows the methodology of [Buhari et al. \(2020\)](#). This study analyzes household food (HF) and household offspring education (HOE) as a function of tobacco expenditure and other variables, as considered below:

The estimated equation for household food is:

$$HF_{it} = \beta_0 + \beta_1 TE_{it} + (\beta_1 TE_{it} \times \beta_2 INEQ_{it}) + \beta_3 GenderD_{it} + \beta_4 HHincome_{it} + \beta_5 EMPL_{it} + \beta_6 MAR_{it} + \beta_7 EduL + \beta_8 RaceD_{it} + \beta_9 LocD_{it} + \beta_{10} ProvD_{it} + \varepsilon_{it}$$

The estimated equation for household offspring education is:

$$HOE_{it} = \beta_0 + \beta_1 TE_{it} + (\beta_1 TE_{it} \times \beta_2 INEQ_{it}) + \beta_3 GenderD_{it} + \beta_4 HHincome_{it} + \beta_5 EMPL_{it} + \beta_6 MAR_{it} + \beta_7 EduL + \beta_8 RaceD_{it} + \beta_9 LocD_{it} + \beta_{10} ProvD_{it} + \varepsilon_{it}$$

where  $i$  is the head of the household ( $i = 1, 2, \dots, N$ ) and  $t$  is the time ( $t = 1, 2, \dots, T$ ). The response variable is the household food allocation (HF), which is defined by the household's total food consumption. In contrast, offspring education allocation (HOE) is defined by the sum of school fees, schoolbooks, school uniforms, and other school expenditures. The household tobacco expenditure (TE) serves as the main explanatory variable, proxied by the household head's smoking status, which is several cigarettes smoked daily by a household multiplied by 30 days for a monthly consumption. To calculate tobacco expenditure, multiply the number of cigarettes smoked per month by the cigarette unit price. The unit price differed in different waves, and this was administered accordingly. The variable that interacts with tobacco expenditure and inequality (race, education, and gender) is shown as *INEQ*. The *INEQ* variable represents the interaction of inequality of race multiplied by tobacco consumption, the interaction of inequality of race multiplied by tobacco consumption, the interaction of inequality of education multiplied by tobacco consumption, and the interaction of inequality of gender multiplied by tobacco consumption. Household head education status (*EduL*) (where "no education" is a reference variable in a binary), racial dummy variable (*RaceD*) in the South African context (where 1 is black and the rest of the variables are referred to as non-black (colored, Indian, and white), married household head (*MAR*), location dummy (*LocD*) indicating the place of residence (whether respondents live in an urban or rural area), and gender of the household head. Household expenditure on offspring education and food, total tobacco expenditure, and household income (*HHincome*) are all logged, with the age of the household head being a continuous variable and all other variables being dummy variables.

The probit function is employed to calculate the inverse Mills ratio, which will be incorporated into the second equation to account for selection bias. The final econometric difficulty is the possible endogeneity of the variable measuring cigarette expenditures. Using the procedure described by [Strauss et al. \(1993\)](#) and [Rivers and Vuong \(1988\)](#), the residual from the equation estimating tobacco spending is incorporated in the probit regression. A test for exogeneity is the  $t$ -test on its coefficient (the null hypothesis is exogeneity). In the first step of regression, dummy variables for smoking, demographic composition variables, and dummy variables for gender of the head of household, race, and educational status of the head of household are used to identify constraints. The principle is that these variables, especially inequality variables, have a direct effect on food and child education input demand. Table 2 provides summary data for the variables utilized in the quantile regression, and Table 3 provides estimates for the coefficients.

**Table 2.** Descriptive statistics for the variables utilized in this study.

Variable	Mean	Sd	Min	Max
Household head age	48.865	15.5864	1	100
Household head with no education	0.2812	0.4150	0	1
Household head education	0.7229	0.4475	0	1
Smoking frequency	7.7301	6.7419	1	80
HHincome	7522.68	19,365.39	0	2,605,524
Household that are depressed	0.4723	0.4992	0	1
Offspring education expenditure	124.756	1087.642	0	140,000
Household food (HF)	1313.296	1479.052	0	200,000
Married_household head	0.3629	0.4808	0	1
Unmarried_household head	0.6370	0.4808	0	1
Female	0.5764	0.4941	0	1
Black	0.7983	0.4012	0	1
Non_black	0.2016	0.4012	0	1
Urban	0.5441	0.4980	0	1
Rural	0.4558	0.4980	0	1
Male	0.4235	0.4941	0	1
Western_cape	0.1060	0.3079	0	1
Eastern_cape	0.1298	0.3361	0	1
Northern_Cape	0.0719	0.258	0	1
Free_State	0.0552	0.2284	0	1
Kwazulu_Natal	0.2937	0.4554	0	1
North_West	0.0688	0.2531	0	1
Gauteng	0.1116	0.3149	0	1
Mpumalanga	0.0712	0.2571	0	1
Limpopo	0.0914	0.2881	0	1
Household head employed	0.5615	0.4962	0	1

Source: Author's calculations using NIDS database (2008–2017).



**Table 3.** Substitution effect of tobacco consumption on household offspring education (column A) and food expenditure (Column B) interacted with household head level of education.

Education Interacted	Household Offspring Education Expenditure (Column A)								Household Food Expenditure (Column B)							
	Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)				Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)			
Variables	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00
Tobacco expenditure	−0.210 **	−0.073	0.040	−0.59 ***	−0.362 **	−0.111	0.0992	−1.03 ***	0.0566 ***	0.0522 ***	0.0484 ***	0.0422 **	0.0467 **	0.0402 **	0.0344 *	0.0251
	(0.0819)	(0.0684)	(0.0723)	(0.175)	(0.146)	(0.123)	(0.130)	(0.303)	(0.0164)	(0.0136)	(0.0144)	(0.0206)	(0.0237)	(0.0196)	(0.0207)	(0.0296)
Household head education	−0.244	0.0206	0.242	−0.99 **	−1.364	−0.253	0.681	−4.327 **	−0.039	−0.002	0.0304	0.082 *	−0.122	−0.104	−0.0871	−0.060
	(0.214)	(0.179)	(0.189)	(0.449)	(0.895)	(0.752)	(0.795)	(1.817)	(0.0365)	(0.0303)	(0.0320)	(0.0460)	(0.165)	(0.137)	(0.144)	(0.207)
Hheducation and smoking					0.212	0.051	−0.083	0.641 *					0.0156	0.0192	0.0224	0.0274
					(0.173)	(0.145)	(0.154)	(0.348)					(0.0305)	(0.0253)	(0.0266)	(0.0382)
Household income	0.64 ***	0.61 ***	0.58 ***	0.75 ***	0.64 ***	0.61 ***	0.58 ***	0.72 ***	0.426 ***	0.431 ***	0.43 ***	0.44 ***	0.42 ***	0.43 ***	0.43 ***	0.44 ***
	(0.0729)	(0.0608)	(0.0645)	(0.151)	(0.0730)	(0.0612)	(0.0648)	(0.145)	(0.0149)	(0.0124)	(0.0131)	(0.0188)	(0.0149)	(0.0124)	(0.0131)	(0.0187)
Urban	0.307	0.0879	−0.0954	0.925 **	0.344	0.101	−0.103	0.992 **	−0.0369	−0.0204	−0.00603	0.0170	−0.0365	−0.0198	−0.00504	0.0184
	(0.219)	(0.183)	(0.193)	(0.456)	(0.221)	(0.185)	(0.196)	(0.446)	(0.0387)	(0.0321)	(0.0339)	(0.0487)	(0.0388)	(0.0321)	(0.0339)	(0.0486)
Black	−0.312	0.086	0.420	−1.438	−0.352	0.0705	0.425	−1.477	−0.38 ***	−0.37 ***	−0.36 ***	−0.34 ***	−0.38 ***	−0.37 ***	−0.36 ***	−0.34 ***
	(0.472)	(0.394)	(0.417)	(0.981)	(0.471)	(0.396)	(0.419)	(0.946)	(0.0918)	(0.0762)	(0.0805)	(0.115)	(0.0919)	(0.0761)	(0.0803)	(0.115)
Household head depressed	0.0763	0.0171	−0.0324	0.243	0.0881	0.0200	−0.0371	0.270	−0.0150	−0.0162	−0.0172	−0.0189	−0.0147	−0.0159	−0.0170	−0.0188
	(0.155)	(0.129)	(0.137)	(0.320)	(0.155)	(0.130)	(0.138)	(0.307)	(0.0301)	(0.0249)	(0.0263)	(0.0378)	(0.0301)	(0.0249)	(0.0263)	(0.0377)
Female	−0.662	−0.0008	0.552	−2.526	−0.734	−0.0276	0.565	−2.616 *	−0.174	−0.112	−0.0571	0.0302	−0.176	−0.113	−0.0577	0.0306
	(0.739)	(0.617)	(0.654)	(1.537)	(0.736)	(0.618)	(0.654)	(1.480)	(0.137)	(0.114)	(0.120)	(0.173)	(0.138)	(0.114)	(0.120)	(0.172)
MILLS	0.618	0.0517	−0.421	2.213	0.674	0.0753	−0.428	2.271 *	0.232 *	0.178 *	0.131	0.0564	0.233 *	0.179 *	0.132	0.0563
	(0.652)	(0.544)	(0.577)	(1.356)	(0.649)	(0.545)	(0.576)	(1.303)	(0.123)	(0.102)	(0.108)	(0.154)	(0.123)	(0.102)	(0.107)	(0.154)
Household head employed	0.53 ***	0.37 ***	0.251 *	0.96 ***	0.53 ***	0.38 ***	0.254 *	0.93 ***	0.0444	0.0294	0.0164	−0.00448	0.0444	0.0302	0.0175	−0.00250
	(0.166)	(0.139)	(0.147)	(0.346)	(0.165)	(0.139)	(0.147)	(0.332)	(0.0293)	(0.0243)	(0.0257)	(0.0369)	(0.0294)	(0.0244)	(0.0257)	(0.0369)

Table 3. Cont.

Education Interacted	Household Offspring Education Expenditure (Column A)								Household Food Expenditure (Column B)							
	Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)				Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)			
Married_household head	0.00401	0.144	0.261 *	−0.391	0.00996	0.143	0.256 *	−0.346	0.173 ***	0.193 ***	0.211 ***	0.239 ***	0.174 ***	0.193 ***	0.211 ***	0.239 ***
	(0.160)	(0.134)	(0.142)	(0.333)	(0.160)	(0.134)	(0.142)	(0.321)	(0.0299)	(0.0248)	(0.0262)	(0.0377)	(0.0300)	(0.0248)	(0.0262)	(0.0376)
Eastern Cape	0.0398	0.208	0.349	−0.435	−0.0002	0.196	0.361	−0.524	−0.105 *	−0.0948 *	−0.0856 *	−0.0710	−0.106 *	−0.0954 *	−0.0862 *	−0.0717
	(0.319)	(0.267)	(0.283)	(0.660)	(0.319)	(0.268)	(0.284)	(0.636)	(0.0587)	(0.0487)	(0.0515)	(0.0738)	(0.0588)	(0.0487)	(0.0514)	(0.0737)
Northern Cape	−0.111	−0.0754	−0.0457	−0.211	−0.108	−0.0753	−0.0483	−0.193	−0.095 **	−0.105 ***	−0.114 ***	−0.128 **	−0.094 **	−0.10 ***	−0.11 ***	−0.128 **
	(0.239)	(0.199)	(0.211)	(0.492)	(0.239)	(0.200)	(0.212)	(0.473)	(0.0455)	(0.0378)	(0.0399)	(0.0573)	(0.0456)	(0.0378)	(0.0398)	(0.0571)
Free State	0.335	0.457 **	0.560 **	−0.0112	0.341	0.457 **	0.554 **	0.0312	−0.0873	−0.0635	−0.0426	−0.00934	−0.0874	−0.0635	−0.0423	−0.00859
	(0.278)	(0.232)	(0.246)	(0.574)	(0.277)	(0.232)	(0.246)	(0.550)	(0.0596)	(0.0494)	(0.0522)	(0.0749)	(0.0597)	(0.0494)	(0.0521)	(0.0748)
KwaZulu_Natal	0.0602	0.233	0.378	−0.427	0.0480	0.228	0.379	−0.431	−0.0521	−0.0295	−0.00967	0.0220	−0.0527	−0.0296	−0.00918	0.0233
	(0.393)	(0.328)	(0.348)	(0.811)	(0.391)	(0.328)	(0.347)	(0.776)	(0.0736)	(0.0611)	(0.0645)	(0.0926)	(0.0737)	(0.0611)	(0.0644)	(0.0924)
North West	0.644 **	0.599 **	0.561 **	0.770	0.614 **	0.591 **	0.572 **	0.675	−0.246 ***	−0.160 ***	−0.0853	0.0346	−0.24 ***	−0.16 ***	−0.0862	0.0335
	(0.312)	(0.260)	(0.276)	(0.642)	(0.312)	(0.262)	(0.277)	(0.618)	(0.0701)	(0.0581)	(0.0614)	(0.0883)	(0.0702)	(0.0581)	(0.0613)	(0.0881)
Gauteng	0.147	0.309	0.445 *	−0.310	0.132	0.302	0.445 *	−0.323	−0.148 **	−0.0973 *	−0.0530	0.0177	−0.148 **	−0.0977 *	−0.0528	0.0186
	(0.295)	(0.246)	(0.261)	(0.611)	(0.294)	(0.246)	(0.261)	(0.585)	(0.0637)	(0.0528)	(0.0558)	(0.0801)	(0.0638)	(0.0528)	(0.0557)	(0.0800)
Mpumalanga	0.0121	0.206	0.367	−0.533	−0.0223	0.196	0.379	−0.604	−0.259 ***	−0.184 ***	−0.119 *	−0.0141	−0.26 ***	−0.18 ***	−0.118 *	−0.0110
	(0.403)	(0.337)	(0.357)	(0.833)	(0.403)	(0.338)	(0.358)	(0.802)	(0.0804)	(0.0667)	(0.0705)	(0.101)	(0.0807)	(0.0668)	(0.0705)	(0.101)
Limpopo	0.0695	0.158	0.231	−0.179	0.0631	0.155	0.231	−0.181	−0.245 ***	−0.228 ***	−0.213 ***	−0.189 *	−0.24 ***	−0.22 ***	−0.21 ***	−0.189 *
	(0.442)	(0.369)	(0.391)	(0.912)	(0.440)	(0.369)	(0.391)	(0.871)	(0.0796)	(0.0660)	(0.0698)	(0.100)	(0.0797)	(0.0660)	(0.0696)	(0.0999)
Age Household head	−0.0007	−0.004	−0.008	0.0111	−0.000	−0.004	−0.008	0.0108	0.001	0.001	0.000	−0.000	0.001	0.0011	0.000	−0.000
	(0.007)	(0.006)	(0.006)	(0.0161)	(0.007)	(0.006)	(0.006)	(0.015)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Wave 2	−0.59 ***	−0.47 ***	−0.37 **	−0.92 **	−0.6 ***	−0.48 ***	−0.378 **	−0.936 **	0.0410	0.0170	−0.003	−0.0375	0.0400	0.0162	−0.004	−0.038
	(0.197)	(0.165)	(0.175)	(0.409)	(0.196)	(0.165)	(0.175)	(0.392)	(0.0375)	(0.0311)	(0.0328)	(0.0471)	(0.0376)	(0.0311)	(0.0328)	(0.0471)
Wave 3	−0.299	−0.344 **	−0.382 **	−0.172	−0.305 *	−0.345 **	−0.378 **	−0.198	0.0528	0.0503	0.0481	0.0446	0.0519	0.0494	0.0472	0.0437
	(0.183)	(0.152)	(0.162)	(0.377)	(0.181)	(0.152)	(0.161)	(0.359)	(0.0393)	(0.0326)	(0.0345)	(0.0494)	(0.0394)	(0.0326)	(0.0344)	(0.0494)

Table 3. Cont.

Education Interacted	Household Offspring Education Expenditure (Column A)								Household Food Expenditure (Column B)							
	Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)				Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)			
Wave 4	−0.298	−0.115	0.0378	−0.813	−0.243	−0.104	0.0130	−0.615	0.183 ***	0.158 ***	0.136 ***	0.102 *	0.185 ***	0.162 ***	0.141 ***	0.108 *
	(0.273)	(0.228)	(0.241)	(0.565)	(0.276)	(0.231)	(0.245)	(0.549)	(0.0455)	(0.0378)	(0.0399)	(0.0573)	(0.0459)	(0.0380)	(0.0401)	(0.0575)
Wave 5	−0.183	−0.102	−0.0345	−0.410	−0.113	−0.0858	−0.0627	−0.187	0.258 ***	0.221 ***	0.189 ***	0.137 **	0.261 ***	0.226 ***	0.195 ***	0.145 **
	(0.263)	(0.219)	(0.233)	(0.542)	(0.270)	(0.227)	(0.240)	(0.535)	(0.0465)	(0.0386)	(0.0408)	(0.0585)	(0.0470)	(0.0389)	(0.0410)	(0.0589)
Constant	−0.795	0.576	1.722	−4.658 *	−0.0487	0.726	1.377	−2.114	2.241 ***	2.676 ***	3.058 ***	3.667 ***	2.294 ***	2.740 ***	3.136 ***	3.764 ***
	(1.351)	(1.128)	(1.195)	(2.817)	(1.448)	(1.214)	(1.287)	(2.879)	(0.247)	(0.205)	(0.217)	(0.312)	(0.264)	(0.219)	(0.231)	(0.332)
Observations	589	589	589	589	589	589	589	589	3032	3032	3032	3032	3032	3032	3032	3032

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

#### 4. Descriptive Statistics and Preliminary Analysis

Table 2 provides the descriptive statistics of the variables used in the empirical analysis, focusing on the means and standard deviations. There are some noticeable figures: for some variables, on average, household heads spent R124.65 per month on offspring education, while the average food allocation per household head was R1 313.29 per month. In this study's sample, only 72% of household heads were educated, while 28% were uneducated. On average, 56% of the household heads were employed, according to the sample.

#### 5. Empirical Results

We examined the substitution effect of tobacco consumption by different socioeconomic classes, classified as the poor class, the middle class, and the elite. The result of the methods of moments quantile regression indicating the poor, which are sometimes classified as the heads of low-income earners, middle-income earners, and high-income earner households, is shown in Tables 3–5. The study investigates whether gender, educational, and racial differences in conjunction with smoking contribute to the reduction of expenditure on essential goods by the household head (reported in Tables 3–5). The empirical estimates of the two outcome variables (food and offspring education) obtained using moments quantile regression methods are investigated while accounting for inequality conditions (education level of household head, gender of household head, and race of household head).

The first column reports results for children's (log) education, while the second focuses on household (log) food expenditure. To demonstrate the effect of a tobacco expenditure increase under various scenarios, we simulate lower (0.25), middle (0.50; 0.75), and upper (1.0) socioeconomic classes, with elasticity for each quantile. The estimates reflect changes in the income groups of the household head when tobacco expenditure increases, which leads to changes in the consumption patterns of entire households. More specifically, we show the impact of tobacco consumption in combination with inequality because of either the educational level of the household head, the gender of the household head, or the race of the household head.

The first analysis (Table 3) reports the results for the estimated offspring education (column A) and food expenditure (column B) if the household head was smoking and educated; the second (Table 4) reports the offspring education and food expenditure if the household head was smoking and belonged to the black racial group; and finally, the last (Table 5) shows estimates for offspring education and food expenditure if the household head were female and spends on tobacco.

As shown in Table 3, the tobacco expenditure coefficient is negative and significantly related to offspring education (column A). The negative coefficients for the smoking expenditure of 0.21 and 0.59 (Model 1) indicate that the substitution effect mainly appears to be decreasing offspring education in poor and rich households, respectively. According to the results, the more household head tobacco expenditure increases, the lower the expenditure for essential goods, which affects household welfare. For instance, if we assume that the level of education of the smoking household head influences allocation behavior for the rich, the estimates indicate that household heads with education compared to the illiterate will increase household offspring education by 0.64%. However, an increase in tobacco expenditures by educated household heads in the lower and higher quantiles in Model 2 (−0.36 and −1.03) is expected to decrease household offspring expenditures (Table 3). This represents the substitution effect, where household heads substitute their offspring's education for their consumption of tobacco. Household heads living in urban areas spend more on the education of their offspring than those in rural dwellings.

**Table 4.** Substitution effect of tobacco consumption on household offspring education and food expenditure (interacted with household head's race).

Education Interacted	Household Offspring Education Expenditure (Column A)								Household Food Expenditure (Column B)							
	Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)				Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)			
Variables	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00
Tobacco expenditure	−0.210 **	−0.0734	0.0409	−0.59 ***	0.0357	0.0680	0.0980	−0.0423	0.0613 ***	0.0553 ***	0.0496 ***	0.0786 **	0.0800 ***	0.0684 ***	0.0575 ***	0.114 ***
	(0.0875)	(0.0721)	(0.0738)	(0.175)	(0.112)	(0.0989)	(0.108)	(0.201)	(0.0160)	(0.0136)	(0.0144)	(0.0322)	(0.0212)	(0.0189)	(0.0211)	(0.0429)
Black	−0.312	0.0867	0.420	−1.438	2.250 **	1.677 **	1.145	3.634 **	−0.439 ***	−0.432 ***	−0.425 ***	−0.461 **	−0.236	−0.286 *	−0.333 *	−0.0887
	(0.454)	(0.409)	(0.461)	(0.944)	(0.954)	(0.827)	(0.891)	(1.709)	(0.0914)	(0.0771)	(0.0814)	(0.183)	(0.193)	(0.163)	(0.175)	(0.399)
Black and smoking					−0.46 ***	−0.289 **	−0.124	−0.89 ***					−0.0363	−0.026	−0.016	−0.0662
					(0.163)	(0.138)	(0.143)	(0.292)					(0.0316)	(0.026)	(0.027)	(0.0655)
Household income	0.648 ***	0.611 ***	0.580 ***	0.753 ***	0.644 ***	0.612 ***	0.582 ***	0.721 ***	0.407 ***	0.417 ***	0.427 ***	0.377 ***	0.405 ***	0.416 ***	0.426 ***	0.374 ***
	(0.0632)	(0.0614)	(0.073)	(0.132)	(0.063)	(0.061)	(0.073)	(0.115)	(0.018)	(0.014)	(0.015)	(0.038)	(0.018)	(0.014)	(0.0151)	(0.0394)
Urban	0.307	0.0879	−0.095	0.925 **	0.287	0.101	−0.070	0.735 **	−0.015	−0.001	0.012	−0.058	−0.018	−0.003	0.0116	−0.0657
	(0.204)	(0.180)	(0.200)	(0.424)	(0.201)	(0.180)	(0.200)	(0.361)	(0.0397)	(0.031)	(0.032)	(0.080)	(0.039)	(0.031)	(0.0321)	(0.0814)
Depressed household head	0.0763	0.0171	−0.032	0.243	0.095	0.025	−0.039	0.265	−0.016	−0.012	−0.009	−0.026	−0.017	−0.013	−0.009	−0.0282
	(0.152)	(0.134)	(0.148)	(0.308)	(0.151)	(0.134)	(0.149)	(0.269)	(0.029)	(0.024)	(0.026)	(0.058)	(0.029)	(0.024)	(0.026)	(0.0597)
Female	−0.662	−0.00086	0.552	−2.526 *	−0.555	0.068	0.647	−2.061	−0.290 **	−0.234 **	−0.182	−0.449	−0.279 **	−0.227 **	−0.178	−0.432
	(0.712)	(0.634)	(0.709)	(1.483)	(0.703)	(0.636)	(0.719)	(1.288)	(0.136)	(0.115)	(0.122)	(0.274)	(0.137)	(0.115)	(0.122)	(0.280)
Education household head	−0.244	0.0206	0.242	−0.992 **	−0.206	0.040	0.268	−0.799 **	−0.023	0.001	0.025	−0.096	−0.022	0.002	0.025	−0.0962
	(0.225)	(0.186)	(0.182)	(0.425)	(0.212)	(0.183)	(0.185)	(0.352)	(0.034)	(0.029)	(0.030)	(0.070)	(0.034)	(0.029)	(0.030)	(0.0715)
MILLS	0.618	0.0517	−0.421	2.213 *	0.505	−0.020	−0.509	1.775	0.291 **	0.246 **	0.204 *	0.420 *	0.279 **	0.239 **	0.201 *	0.399
	(0.641)	(0.572)	(0.639)	(1.339)	(0.632)	(0.571)	(0.647)	(1.167)	(0.119)	(0.102)	(0.109)	(0.238)	(0.119)	(0.102)	(0.109)	(0.243)
Employed household head	0.532 ***	0.379 ***	0.251 *	0.964 ***	0.501 ***	0.360 ***	0.230	0.839 ***	0.0357	0.0183	0.00201	0.0858	0.0337	0.016	0.000	0.0837
	(0.165)	(0.139)	(0.145)	(0.318)	(0.164)	(0.139)	(0.144)	(0.288)	(0.0300)	(0.024)	(0.025)	(0.0622)	(0.0301)	(0.0247)	(0.0256)	(0.0636)

Table 4. Cont.

Education Interacted	Household Offspring Education Expenditure (Column A)									Household Food Expenditure (Column B)						
	Model 1 (No Interaction)			Model 2 (Interacted with Household Head Level of Education)						Model 1 (No Interaction)			Model 2 (Interacted with Household Head Level of Education)			
Married household head	0.00401	0.144	0.261 *	−0.391	0.00362	0.144	0.275 **	−0.336	0.102 ***	0.124 ***	0.145 ***	0.0392	0.102 ***	0.124 ***	0.145 ***	0.0353
	(0.158)	(0.131)	(0.138)	(0.331)	(0.157)	(0.131)	(0.138)	(0.288)	(0.0323)	(0.0275)	(0.0296)	(0.0662)	(0.0324)	(0.0275)	(0.0295)	(0.0675)
Eastern Cape	0.0398	0.208	0.349	−0.435	0.0734	0.226	0.368	−0.296	−0.127 **	−0.116 **	−0.107 **	−0.157	−0.128 **	−0.118 **	−0.108 **	−0.160
	(0.311)	(0.285)	(0.324)	(0.635)	(0.308)	(0.282)	(0.321)	(0.564)	(0.0609)	(0.0497)	(0.0513)	(0.124)	(0.0611)	(0.0498)	(0.0513)	(0.127)
Northern Cape	−0.111	−0.0754	−0.0457	−0.211	−0.0756	−0.0586	−0.0428	−0.117	−0.112 **	−0.114 ***	−0.116 ***	−0.106	−0.113 **	−0.115 ***	−0.116 ***	−0.109
	(0.230)	(0.201)	(0.221)	(0.476)	(0.227)	(0.198)	(0.218)	(0.415)	(0.0449)	(0.0377)	(0.0404)	(0.0919)	(0.0450)	(0.0377)	(0.0403)	(0.0938)
Free State	0.335	0.457 *	0.560 **	−0.0112	0.354	0.460 *	0.559 **	0.0967	−0.0960 *	−0.0652	−0.0364	−0.184	−0.0969 *	−0.0655	−0.0362	−0.190
	(0.268)	(0.244)	(0.274)	(0.536)	(0.266)	(0.242)	(0.271)	(0.469)	(0.0575)	(0.0487)	(0.0518)	(0.116)	(0.0577)	(0.0487)	(0.0516)	(0.119)
KwaZulu_Natal	0.0602	0.233	0.378	−0.427	0.122	0.297	0.459	−0.300	−0.0856	−0.0737	−0.0626	−0.120	−0.0835	−0.0719	−0.0610	−0.118
	(0.392)	(0.344)	(0.382)	(0.821)	(0.392)	(0.344)	(0.380)	(0.728)	(0.0728)	(0.0618)	(0.0665)	(0.148)	(0.0730)	(0.0618)	(0.0662)	(0.151)
North West	0.644 **	0.599 **	0.561 *	0.770	0.660 **	0.617 **	0.577 *	0.765	−0.273 ***	−0.186 ***	−0.106 *	−0.520 ***	−0.274 ***	−0.187 ***	−0.106 *	−0.532 ***
	(0.283)	(0.272)	(0.313)	(0.551)	(0.286)	(0.272)	(0.314)	(0.499)	(0.0771)	(0.0611)	(0.0621)	(0.165)	(0.0772)	(0.0611)	(0.0620)	(0.168)
Gauteng	0.147	0.309	0.445	−0.310	0.165	0.319	0.463 *	−0.208	−0.140 **	−0.0950 *	−0.0531	−0.268 **	−0.138 **	−0.0931 *	−0.0514	−0.270 **
	(0.299)	(0.253)	(0.272)	(0.628)	(0.297)	(0.251)	(0.270)	(0.558)	(0.0593)	(0.0518)	(0.0567)	(0.119)	(0.0594)	(0.0518)	(0.0565)	(0.122)
Mpumalanga	0.0121	0.206	0.367	−0.533	0.0791	0.264	0.436	−0.368	−0.273 ***	−0.191 ***	−0.115	−0.509 ***	−0.272 ***	−0.190 ***	−0.113	−0.517 ***
	(0.429)	(0.334)	(0.329)	(0.889)	(0.427)	(0.336)	(0.328)	(0.802)	(0.0796)	(0.0664)	(0.0706)	(0.166)	(0.0799)	(0.0665)	(0.0705)	(0.170)
Limpopo	0.0695	0.158	0.231	−0.179	0.190	0.234	0.274	0.0851	−0.246 ***	−0.238 ***	−0.231 ***	−0.268 *	−0.244 ***	−0.237 ***	−0.230 ***	−0.265 *
	(0.424)	(0.367)	(0.394)	(0.849)	(0.416)	(0.362)	(0.388)	(0.741)	(0.0679)	(0.0638)	(0.0748)	(0.137)	(0.0681)	(0.0638)	(0.0745)	(0.140)
Age Household head	−0.000	−0.004	−0.00850	0.0111	−0.00226	−0.0061	−0.009	0.007	0.001	0.001	0.000	0.002	0.001	0.001	0.000	0.002
	(0.007)	(0.006)	(0.006)	(0.018)	(0.007)	(0.006)	(0.007)	(0.014)	(0.001)	(0.001)	(0.00117)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)



Table 4. Cont.

Education Interacted	Household Offspring Education Expenditure (Column A)								Household Food Expenditure (Column B)							
	Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)				Model 1 (No Interaction)				Model 2 (Interacted with Household Head Level of Education)			
Wave 2	−0.59 ***	−0.47 ***	−0.379 **	−0.925 **	−0.55 ***	−0.456 ***	−0.365 **	−0.794 **	0.0374	0.0133	−0.00917	0.107	0.0387	0.0146	−0.00785	0.110
	(0.192)	(0.161)	(0.169)	(0.392)	(0.192)	(0.162)	(0.168)	(0.346)	(0.0367)	(0.0304)	(0.0318)	(0.0744)	(0.0365)	(0.0303)	(0.0317)	(0.0749)
Wave 3	−0.299	−0.344 **	−0.382 **	−0.172	−0.246	−0.302 **	−0.355 **	−0.109	0.0585	0.0528	0.0474	0.0751	0.0604	0.0543	0.0486	0.0785
	(0.186)	(0.151)	(0.154)	(0.381)	(0.189)	(0.152)	(0.152)	(0.344)	(0.0423)	(0.0340)	(0.0352)	(0.0878)	(0.0422)	(0.0340)	(0.0352)	(0.0891)
Wave 4	−0.298	−0.115	0.0378	−0.813	−0.221	−0.0703	0.0695	−0.585	0.209 ***	0.171 ***	0.135 ***	0.319 ***	0.211 ***	0.173 ***	0.137 ***	0.323 ***
	(0.291)	(0.235)	(0.231)	(0.591)	(0.275)	(0.230)	(0.231)	(0.490)	(0.0436)	(0.0366)	(0.0385)	(0.0879)	(0.0437)	(0.0366)	(0.0384)	(0.0897)
Wave 5	−0.183	−0.102	−0.0345	−0.410	−0.0978	−0.0495	−0.00464	−0.215	0.288 ***	0.237 ***	0.189 ***	0.434 ***	0.291 ***	0.240 ***	0.192 ***	0.442 ***
	(0.274)	(0.231)	(0.238)	(0.537)	(0.261)	(0.227)	(0.240)	(0.450)	(0.0439)	(0.0378)	(0.0408)	(0.0884)	(0.0440)	(0.0379)	(0.0409)	(0.0902)
Constant	−0.795	0.576	1.722	−4.658	−1.900	−0.136	1.501	−6.160 **	2.189 ***	2.578 ***	2.942 ***	1.072 **	2.119 ***	2.529 ***	2.911 ***	0.907 *
	(1.331)	(1.149)	(1.260)	(2.828)	(1.392)	(1.221)	(1.350)	(2.613)	(0.252)	(0.209)	(0.221)	(0.525)	(0.259)	(0.216)	(0.228)	(0.550)
Observations	589	589	589	589	589	589	589	589	3032	3032	3032	3032	3032	3032	3032	3032

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

**Table 5.** Substitution effect of tobacco consumption on household offspring education and food expenditure (interacted with household head's gender).

Variables	Household Offspring Education Expenditure (Column A)								Household Food Expenditure (Column B)							
	Model 1 (No Interaction)				Model 2 (Interacted with Household Head Gender)				Model 1 (No Interaction)				Model 2 (Interacted with Household Head Gender)			
	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00
Tobacco expenditure	−0.210 **	−0.0734	0.0409	−0.59 ***	−0.204 **	−0.0486	0.0897	−0.65 ***	0.0566 ***	0.0522 ***	0.0484 ***	0.0696 **	0.0590 ***	0.0560 ***	0.0534 ***	0.0678 *
	(0.0875)	(0.0721)	(0.0738)	(0.175)	(0.0999)	(0.0820)	(0.0838)	(0.205)	(0.0164)	(0.0137)	(0.0144)	(0.0343)	(0.0178)	(0.0149)	(0.0157)	(0.0369)
Female	−0.662	−0.00086	0.552	−2.526 *	−0.453	0.589	1.518	−3.443	−0.174	−0.112	−0.0571	−0.358	−0.111	−0.0194	0.0602	−0.380
	(0.712)	(0.634)	(0.709)	(1.483)	(1.270)	(1.048)	(1.082)	(2.627)	(0.136)	(0.115)	(0.121)	(0.283)	(0.273)	(0.215)	(0.220)	(0.596)
Female and tobacco expenditure					−0.0413	−0.116	−0.182	0.173					−0.0116	−0.0166	−0.0209	0.00316
					(0.184)	(0.153)	(0.158)	(0.370)					(0.0412)	(0.0320)	(0.0323)	(0.0900)
Household income	0.648 ***	0.611 ***	0.580 ***	0.753 ***	0.649 ***	0.609 ***	0.573 ***	0.765 ***	0.426 ***	0.431 ***	0.435 ***	0.413 ***	0.426 ***	0.431 ***	0.435 ***	0.413 ***
	(0.0632)	(0.0614)	(0.0734)	(0.132)	(0.0632)	(0.0610)	(0.0731)	(0.132)	(0.0193)	(0.0149)	(0.0147)	(0.0415)	(0.0192)	(0.0149)	(0.0147)	(0.0415)
Urban	0.307	0.0879	−0.0954	0.925 **	0.310	0.0857	−0.114	0.955 **	−0.0369	−0.0204	−0.00603	−0.0855	−0.0375	−0.0217	−0.00792	−0.0842
	(0.204)	(0.180)	(0.200)	(0.424)	(0.206)	(0.182)	(0.202)	(0.434)	(0.0403)	(0.0320)	(0.0320)	(0.0844)	(0.0401)	(0.0319)	(0.0321)	(0.0838)
Black	−0.312	0.0867	0.420	−1.438	−0.319	0.0682	0.413	−1.430	−0.388 ***	−0.375 ***	−0.364 ***	−0.427 **	−0.387 ***	−0.373 ***	−0.360 ***	−0.430 **
	(0.454)	(0.409)	(0.461)	(0.944)	(0.450)	(0.409)	(0.466)	(0.945)	(0.0920)	(0.0767)	(0.0806)	(0.191)	(0.0926)	(0.0769)	(0.0806)	(0.193)
Depressed Household head	0.0763	0.0171	−0.0324	0.243	0.0773	0.0173	−0.0361	0.249	−0.0150	−0.0162	−0.0172	−0.0114	−0.0156	−0.0168	−0.0178	−0.0120
	(0.152)	(0.134)	(0.148)	(0.308)	(0.151)	(0.134)	(0.149)	(0.306)	(0.0297)	(0.0248)	(0.0263)	(0.0620)	(0.0295)	(0.0248)	(0.0264)	(0.0618)
Education Household head	−0.244	0.0206	0.242	−0.992 **	−0.237	0.0125	0.235	−0.952 **	−0.0397	−0.00231	0.0304	−0.150 **	−0.0393	−0.00163	0.0312	−0.151 **
	(0.225)	(0.186)	(0.182)	(0.425)	(0.226)	(0.188)	(0.185)	(0.426)	(0.0347)	(0.0292)	(0.0310)	(0.0735)	(0.0349)	(0.0293)	(0.0309)	(0.0742)
MILLS	0.618	0.0517	−0.421	2.213 *	0.632	0.0685	−0.433	2.247 *	0.232 *	0.178 *	0.131	0.390	0.230 *	0.174 *	0.126	0.395
	(0.641)	(0.572)	(0.639)	(1.339)	(0.638)	(0.573)	(0.646)	(1.345)	(0.119)	(0.101)	(0.108)	(0.247)	(0.119)	(0.102)	(0.109)	(0.248)
Household head employed	0.53 ***	0.37 ***	0.251 *	0.96 ***	0.53 ***	0.39 ***	0.271 *	0.93 ***	0.0444	0.0294	0.0164	0.0884	0.0449	0.0300	0.0171	0.0887
	(0.165)	(0.139)	(0.145)	(0.318)	(0.166)	(0.141)	(0.148)	(0.318)	(0.0304)	(0.0247)	(0.0257)	(0.0648)	(0.0303)	(0.0247)	(0.0257)	(0.0645)
Married household head	0.00401	0.144	0.261 *	−0.391	0.00498	0.138	0.257 *	−0.377	0.173 ***	0.193 ***	0.211 ***	0.115 *	0.174 ***	0.193 ***	0.211 ***	0.115 *
	(0.158)	(0.131)	(0.138)	(0.331)	(0.158)	(0.131)	(0.138)	(0.330)	(0.0307)	(0.0260)	(0.0281)	(0.0651)	(0.0306)	(0.0260)	(0.0281)	(0.0651)
Eastern Cape	0.0398	0.208	0.349	−0.435	0.0314	0.211	0.372	−0.485	−0.105 *	−0.0948 *	−0.0856 *	−0.136	−0.105 *	−0.0946 *	−0.0856 *	−0.135
	(0.311)	(0.285)	(0.324)	(0.635)	(0.313)	(0.285)	(0.325)	(0.639)	(0.0617)	(0.0500)	(0.0514)	(0.130)	(0.0617)	(0.0500)	(0.0515)	(0.130)

Table 5. Cont.

	Household Offspring Education Expenditure (Column A)								Household Food Expenditure (Column B)							
	Model 1 (No Interaction)				Model 2 (Interacted with Household Head Gender)				Model 1 (No Interaction)				Model 2 (Interacted with Household Head Gender)			
Northern Cape	−0.111 (0.230)	−0.0754 (0.201)	−0.0457 (0.221)	−0.211 (0.476)	−0.118 (0.230)	−0.0619 (0.201)	−0.0118 (0.222)	−0.280 (0.474)	−0.0953 ** (0.0455)	−0.105 *** (0.0377)	−0.114 *** (0.0400)	−0.0659 (0.0961)	−0.0948 ** (0.0455)	−0.105 *** (0.0376)	−0.113 *** (0.0399)	−0.0655 (0.0962)
Free State	0.335 (0.268)	0.457 * (0.244)	0.560 ** (0.274)	−0.0112 (0.536)	0.329 (0.272)	0.474 * (0.246)	0.604 ** (0.276)	−0.0897 (0.542)	−0.0873 (0.0590)	−0.0635 (0.0490)	−0.0426 (0.0516)	−0.158 (0.124)	−0.0874 (0.0590)	−0.0629 (0.0490)	−0.0415 (0.0517)	−0.160 (0.124)
KwaZulu_Natal	0.0602 (0.392)	0.233 (0.344)	0.378 (0.382)	−0.427 (0.821)	0.0525 (0.390)	0.227 (0.344)	0.382 (0.385)	−0.447 (0.821)	−0.0521 (0.0735)	−0.0295 (0.0619)	−0.00967 (0.0660)	−0.119 (0.155)	−0.0510 (0.0737)	−0.0281 (0.0620)	−0.00804 (0.0661)	−0.119 (0.155)
North West	0.644 ** (0.283)	0.599 ** (0.272)	0.561 * (0.313)	0.770 (0.551)	0.635 ** (0.282)	0.603 ** (0.271)	0.574 * (0.314)	0.728 (0.548)	−0.246 *** (0.0779)	−0.160 *** (0.0610)	−0.0853 (0.0615)	−0.49 *** (0.171)	−0.246 *** (0.0784)	−0.160 *** (0.0612)	−0.0845 (0.0616)	−0.50 *** (0.173)
Gauteng	0.147 (0.299)	0.309 (0.253)	0.445 (0.272)	−0.310 (0.628)	0.143 (0.303)	0.322 (0.255)	0.482 * (0.273)	−0.370 (0.642)	−0.148 ** (0.0609)	−0.0973 * (0.0522)	−0.0530 (0.0563)	−0.297 ** (0.126)	−0.147 ** (0.0608)	−0.0954 * (0.0523)	−0.0506 (0.0564)	−0.298 ** (0.127)
Mpumalanga	0.0121 (0.429)	0.206 (0.334)	0.367 (0.329)	−0.533 (0.889)	−0.0002 (0.428)	0.206 (0.336)	0.390 (0.332)	−0.592 (0.887)	−0.259 *** (0.0811)	−0.184 *** (0.0661)	−0.119 * (0.0696)	−0.48 *** (0.176)	−0.259 *** (0.0811)	−0.183 *** (0.0662)	−0.118 * (0.0696)	−0.48 *** (0.176)
Limpopo	0.0695 (0.424)	0.158 (0.367)	0.231 (0.394)	−0.179 (0.849)	0.0567 (0.422)	0.151 (0.367)	0.236 (0.396)	−0.215 (0.839)	−0.245 *** (0.0706)	−0.228 *** (0.0651)	−0.213 *** (0.0749)	−0.295 ** (0.147)	−0.244 *** (0.0706)	−0.227 *** (0.0652)	−0.212 *** (0.0749)	−0.295 ** (0.147)
Age household head	−0.000 (0.007)	−0.004 (0.0064)	−0.008 (0.006)	0.0111 (0.0158)	−0.0008 (0.007)	−0.00486 (0.0064)	−0.00845 (0.0070)	0.0107 (0.0158)	0.00171 (0.00144)	0.00116 (0.00116)	0.000670 (0.00117)	0.00335 (0.0030)	0.00168 (0.00144)	0.00111 (0.00116)	0.000608 (0.00117)	0.00337 (0.0030)
Wave 2	−0.59 *** (0.192)	−0.47 *** (0.161)	−0.379 ** (0.169)	−0.925 ** (0.392)	−0.60 *** (0.191)	−0.48 *** (0.161)	−0.377 ** (0.170)	−0.938 ** (0.390)	0.0410 (0.0374)	0.0170 (0.0306)	−0.003 (0.0317)	0.112 (0.0784)	0.0410 (0.0374)	0.0169 (0.0306)	−0.00410 (0.0318)	0.112 (0.0785)
Wave 3	−0.299 (0.186)	−0.344 ** (0.151)	−0.382 ** (0.154)	−0.172 (0.381)	−0.306 * (0.185)	−0.346 ** (0.151)	−0.381 ** (0.155)	−0.191 (0.377)	0.0528 (0.0429)	0.0503 (0.0341)	0.0481 (0.0351)	0.0602 (0.0923)	0.0529 (0.0428)	0.0504 (0.0341)	0.0482 (0.0351)	0.0603 (0.0923)
Wave 4	−0.298 (0.291)	−0.115 (0.235)	0.0378 (0.231)	−0.813 (0.591)	−0.299 (0.291)	−0.123 (0.237)	0.0332 (0.234)	−0.803 (0.594)	0.183 *** (0.0444)	0.158 *** (0.0370)	0.136 *** (0.0387)	0.25 *** (0.0923)	0.183 *** (0.0444)	0.158 *** (0.0370)	0.137 *** (0.0386)	0.25 *** (0.0923)
Wave 5	−0.183 (0.274)	−0.102 (0.231)	−0.0345 (0.238)	−0.410 (0.537)	−0.177 (0.274)	−0.109 (0.232)	−0.0477 (0.240)	−0.374 (0.533)	0.258 ** (0.0448)	0.221 *** (0.0382)	0.189 *** (0.0411)	0.36 *** (0.0931)	0.258 *** (0.0447)	0.221 *** (0.0382)	0.189 *** (0.0410)	0.36 *** (0.0931)
Constant	−0.795 (1.331)	0.576 (1.149)	1.722 (1.260)	−4.658 (2.828)	−0.858 (1.329)	0.408 (1.167)	1.535 (1.299)	−4.488 (2.837)	2.241 *** (0.256)	2.676 *** (0.210)	3.058 *** (0.220)	0.955 * (0.552)	2.232 *** (0.259)	2.664 *** (0.211)	3.041 *** (0.220)	0.953 * (0.557)
Observations	589	589	589	589	589	589	589	589	3032	3032	3032	3032	3032	3032	3032	3032

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

The household head's income, employed and married household head (only for the middle class), female sex (significant only on the high quantile), and offspring education expenditures all increased positively and significantly across the three socioeconomic groups. Similarly, age, place of residence (only on the higher quantile for model 1 and the lower quantile for model 2), and provinces like Free State and Gauteng (only significant in the middle class) and the North West (significant in all quantiles) are positive and spend significantly more on offspring education. On the contrary, the female households that are rich spend less on their children's education. Except for the tobacco consumption expenditure variable, an educated household head had a positive effect on offspring education expenditures in most cases. The age of the household head has no effect on household food expenditures.

The results in Table 3 (column B) indicate that for all quantiles except the high quantile, tobacco expenditure by the household head is associated with a higher food share. The coefficients for tobacco expenditure are positive across all quantiles. Tobacco spending was found to be positive and statistically significant across all socioeconomic levels, with tobacco smoking increasing food expenditure in all quantiles. Household income raises food expenditure in all income groups significantly. Furthermore, the black (non-black, which includes colored, Indian, and white people) population appears to be reducing the portion of resources allocated for food expenditure, whereas the married household head increases household food expenditure, as do provinces such as the Eastern Cape, Northern Cape (all models and all quantiles), and North West (poor and middle in both quantiles); Mpumalanga (all models and all quantiles); and Limpopo (all models and all quantiles). [Efroymson et al. \(2011\)](#) validated this trend, discovering a link between cigarette expenses and lower consumption of household necessities such as food and health. [Koch and Tshiswaka-Kashalala \(2008\)](#) also reported a substitution of household expenditures by tobacco consumption.

Table 4 shows the results of moments quantile regression on all expenditure groups for racial differences in combination with tobacco expenditure by the household head on essential household expenditures (children's education and food). Firstly, focusing on Column A (Model 1), the coefficients are as expected: poor households exhibit a negative and significant effect of tobacco consumption expenditure by the household head on offspring education. The percentage increase in tobacco expenditure leads to the education expenditure decreasing by 21% and 59%, respectively (Models 1 and 2 of the offspring education model). Likewise, the increase in tobacco expenditure by household heads will decrease offspring education expenditure by 0.46% in the poor household, whereas there is a decrease of 0.89% (column A, model 2) in the richest household. This simply means that for both the poorest and richest head of the household, there is a trade-off between smoking expenditure and education for children.

The estimates show that black household heads increase the resources allocated for offspring education (Column A) by 2.250%, 1.677%, and 3.634% (Model 2) in the poor, middle, and high expenditure classes, respectively. Nonetheless, all quantiles indicate that an increase in tobacco expenditure by black household heads will decrease the household children's education (2) in the poor, middle, and high expenditure classes, respectively. Nonetheless, all quantiles indicate that an increase in tobacco expenditure by black household heads will decrease the household children's education (−0.46%, −0.28%, and −0.89% (see Table 4, Model 2), showing a substitution effect between tobacco consumption and household essentials. In the Free State, only the middle class (Models 1 and 2) and the North West spend more on their children's education (Models 1 and 2).

In addition, female household heads (−2.52%) and educated household heads (−0.99% and −0.79% in higher classes) (column A, model 1) show a negative and significantly related relationship to offspring education. This means that female household heads spend less on their children's education than male household heads, and educated household heads spend less than uneducated household heads. Furthermore, the coefficients for household

income, employed status, and married household head in all models are all positive and significantly increase the expenditure on children's education.

On the contrary, the positive sign of the tobacco consumption variable on the food expenditure variable indicates that as tobacco consumption rises, so do food expenditures. The positive coefficient shows that those two goods are equally important to the household head, and thus the increase in tobacco leads to an increase in food. Household income and married household heads increased food expenditures across all quantiles in this study. These results are also compatible with those of studies of a similar nature (Gibson et al. 2003; Coulombe 2008). A female household from the lower and middle class spends less on household food, as evidenced in the table above. All provinces except KwaZulu-Natal (the Eastern Cape, Northern Cape, Free State, North West, Gauteng, Mpumalanga, and Limpopo) showed a negative and significant relationship with food expenditure.

The findings in Table 5 show that for every percentage increase in tobacco expenditure, there is a decrease in offspring education (column A) in both the lower and higher expenditure classes (Models 1 and 2). When the percentage of spending on tobacco by the household head increases, it decreases the spending on household offspring education only in the household with low spending by 0.21% and in the household with higher spending by 0.59% on Model 1 (without interaction). The same trend is observed in Model 2 (model interacted with gender) for offspring education expenditure, which increases by 0.20% in the lower class and decreases by 0.65% in the higher class. Furthermore, female household heads with higher incomes spend less on their children's education. The household head employed variable, household income, and place of residence (higher spending group only) show an increase in offspring education spending in all quantiles. The married household head shows the positive and significant effect of offspring education only on the middle household's spending. The household heads that stay in Free State (from the middle expenditure group), in the North West (all expenditure groups), and Gauteng (only the higher spending group) spend more on their children's education.

The results also showed that tobacco spending was positively and significantly associated with increased spending on household food expenditure in all expenditure groups (Models 1 and 2). This is evident in Model 1 (without interaction). This is especially true for the lowest and highest quantile associates for the poorest and richest population groups. In this sample, all groups view cigarettes as food; as a result, an increase in cigarette spending is accompanied by a corresponding rise in food costs. Comparing female household heads' tobacco spending with male household heads' tobacco spending on food expenditure, this variable shows no significant impact in all quantiles. Household income and a married household head positively increase household food in the lower, middle, and high expenditure groups. On the contrary, black household heads spend less on household food than non-blacks in all the groups. The results also show that compared to non-educated household heads, the educated household heads in the high spending group spent less on household food in the two models (a decrease of 0.15%). Household heads from the Eastern Cape, Northern Cape (in the lower and middle expenditure categories), North West Gauteng, Mpumalanga, and Limpopo (in all the lower, middle, and higher expenditure categories) seem to spend less on household food expenditures.

## 6. Discussion

Using data from the National Income Dynamics Study (NIDS) from 2008–2017, we examined three items of expenditure: food, offspring education, and tobacco expenditure. The analysis employed methods of moments quantile regression. The evidence from the study shows that increases in tobacco consumption by the household head reduce the proportion of spending on offspring education while increasing the proportion of expenditure on household food (as evidenced in Table 3). The results in Table 5 are similar to those in Tables 3 and 4, which also indicate that there is a substitution effect between tobacco expenditure and offspring education. This is the case for the lowest and highest quantiles (Table 5), which correspond to the poorest and wealthiest population groups,

respectively. This means that household heads devote less money to their children's education, indicating a potential intergenerational effect (Wang et al. 2006; John 2008) in which tobacco expenditure has a long-term impact on human capital investment, economic development, and poverty growth (Oktavianti et al. 2022).

When comparing the estimates of female household heads to those of male household heads, estimates revealed an inverse relationship in the higher quantile, indicating that females in the higher expenditure group spend less on children's education, while there was no significant difference in food expenditure across any of the expenditure groups (Table 5). Similar to the findings of Bolghanabadi and Pour (2014), the findings of this study demonstrated that employment increased food allocation while decreasing resource allocation for household children's education in the poor group. The reason might be that poor families with employed household heads have less financial capacity to pay for their children's education than rich families with employed household heads.

All the tables point to the possibility that spending on tobacco products affects what households spend on essentials. Households that spend money on tobacco, on the other hand, may have less money available for all other important needs. Similar outcomes were observed in Turkey and Bangladesh (Efroymson et al. 2001). Furthermore, while the substitution effect is most prevalent in low-income or poor households and wealthy households in South Africa, it has no effect on the middle class or middle-income earners. These educated household heads indicate that they place as much value on their children's education as they do on tobacco purchases, as evidenced by the wealthy households. The education (middle class) and food expenditures of married household heads were higher than those of single household heads, except for the lower classes (for food expenditure). In particular, between the poor and the wealthy, married household heads have a more significant impact on how much money is spent on their children's education and food. The results support Hawk (2011) conclusions that marriage increases household expenditure since married households spend more resources on food.

Variations in household expenditure (household children's education and food model) caused by an increase in tobacco expenditure by the household head are estimated for each quantile based on low, medium, and upper class. The study hypothesizes that inequity and differences in taste or preference may lead to individuals spending more money on non-essential goods such as tobacco. To show the effect of inequality and non-essentials on essential goods, Tables 3–5 also include estimates of the interaction of smoking expenditure with inequality variables (educational level, race, and gender of the household head) by checking whether the combination of these variables could be the drivers of the reduction in household consumption of essential goods. The coefficient of interaction between the tobacco expenditure and education of the household head variable on offspring education is positive and statistically significant in the upper quantile, which means that the educated household heads from the higher class regard offspring education to be just as important as their tobacco spending, as do their uneducated counterparts.

The current study's findings are consistent with previous research, confirming that well-educated household heads invest more in their children's education and food for the rest of the family (Van Voorhis et al. 2013). Estimates for the tobacco expenditure parameter interacted with racial differences, particularly being a black versus a non-black household head, and had a significant negative impact on household offspring education across all expenditure quantiles, but had no significance across all quantiles for food expenditure. This can be explained by the apartheid era in South Africa and the harsh economic conditions that have affected mostly the households of black ethnic groups. The findings align with the evidence presented by Sall (2018), who reported that non-black households continue to be the most prosperous in South Africa. When tobacco spending was interacting with gender, we found no significance for any quantiles in any models (household child and food expenditures), whereas the opposite was true for the first two inequality differences (level of education and racial differences for the household head). The substitution effects are most evident in South Africa's race (more blacks than non-blacks).



Despite previous research indicating that tobacco expenditure reduces households' food spending (John 2008; John et al. 2011), this study discovered a positive and significant coefficient, which is in line with the study by Husain et al. (2018). In this sample, all groups consider cigarettes to be food; as a result, an increase in cigarette spending is accompanied by a decrease in food expenditure, as shown by the positive and significant coefficients for all expenditure groups. These results hold for all the scenarios analyzed. This is a loss for welfare, because consumers would devote a higher share of their incomes to purchasing the same amount of tobacco, thereby reducing the consumption of other goods. Previous studies confirmed the substitution effect of tobacco expenditure on food expenditure, in contrast to what is seen in Tables 3–5 (e.g., San and Chaloupka 2016; Chelwa and Van Walbeek 2014). However, for poor households, food expenditures may be more required than discretionary, occupying a considerable portion of the budget. As a result, substitution effects are apparent in discretionary expenditure items such as children's education (World Health Organization (WHO) (2019)).

## 7. Conclusions

Using NIDS data, this study examines the substitution effect of tobacco spending by household heads on household essentials in South Africa. In this research, the moments quantile regression method is employed for the analysis. This method also addresses endogeneity and heteroscedasticity issues. This research concludes that tobacco consumption reduces the portion spent by the smoking household on household offspring education expenditure in South Africa. Reduced education for children may have long-term negative consequences for future human capital, household living standards, and children's development. In conclusion, it may hinder these households from exiting poverty and worsen existing inequalities.

In contrast, our findings show that the substitution effect is most prevalent among low-income earners or poor households, but has little impact on middle-income earners and high-income earners, also known as the elite or richest households. This could be attributed to the affordability of cigarettes in South Africa. We conclude that the low price of tobacco enables middle- and high-class households to spend more on tobacco consumption and afford to provide for household essentials, whereas it has more effect on poor households. In essence, if people spent more money on non-essentials such as cigarettes, they would have less money for essentials such as food and education (Heffetz and Frank 2010). Therefore, it is preferable for low-income households, in particular, to prioritize the purchase of essentials above non-essentials so as to maximize their household satisfaction. The aggregate effect of such decisions by household heads will be more appropriate for improving household well-being by reducing the share of income spent on non-essentials. We posit that the continually increasing excise tax on tobacco and an increase in the price of cigarettes to reduce the accessibility of tobacco in South Africa can have a significant influence on the reduction of cigarette demand by household heads, and this will boost household welfare by decreasing the substitution effect of tobacco expenditure on household essential goods such as food and education expenditures. Our study illustrates the substitution effect of tobacco expenditure on household expenditures on essential goods, particularly offspring education, among South African household heads who are smokers. The effect is predominantly observed in poor households. This effect may have long-term detrimental effects on the future living standards of households and increase social disparity.

As with most other surveys, the NIDS struggles with nonresponse and attrition. Consequently, the sample size is lowered when a balanced panel is utilized. Furthermore, Kacker (2016) concludes that the NIDS statistics do not align with information from other South African surveys and appear to oversample rural areas, those with low levels of education, and college graduates. The paper is not without limitations. There were some covariates in this study, and although other variables were present in the dataset, they were outside the scope of this study. Therefore, we are aware that omitting some covariates

might also affect the results; therefore, our results were interpreted cautiously. Given these limitations, Kacker (2016) acknowledges that the survey is highly reliable and there is no cause to question the data's dependability. Caution is advised when drawing conclusions from the study, as the NIDS seems to prefer the region of South Africa that has progressed the most.

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