

Smoking habits in Mexico: Upward and downward comparisons of economic status

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Abstract

While experimental and behavioral economics have extensively studied the role of both upward and downward comparisons of economic status, the latter have been largely neglected in secondary data studies. The scarce existing evidence shows mixed results and is essentially limited to analyses of subjective well-being in high-income countries. Using nationally representative data from Mexico with almost 45,000 personal records, we disentangle the role of absolute wealth, relative deprivation, and relative affluence as explanatory variables for smoking behavior. We find robust evidence of greater smoking at higher levels of absolute achievement and relative deprivation and lower smoking at higher levels of relative affluence. Results hold for a variety of indicators of smoking habits, reflecting both smoking prevalence and intensity. Compared to men, we find that women tend to have stronger associations between the three facets of economic status and smoking prevalence. Results are robust to the use of alternative functional forms and reference groups for the measurement of relative deprivation and relative affluence.

KEYWORDS

gender, Mexico, relative affluence, relative deprivation, smoking, wealth

JEL CLASSIFICATION

D31; I14; I31

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1 | INTRODUCTION

While economists have for a long time assumed that individuals are affected by absolute (i.e., own) income and not by the incomes of others, over the past three decades a growing body of literature has strongly challenged this assumption (for reviews covering the survey-based, experimental and theoretical literature, see Clark & D'Ambrosio, 2015; Clark et al., 2008; Esposito, 2018; Verme, 2018). In line with Duesenberry's (1949) "Relative Income Hypothesis," individuals have shown a range of "other-regarding" preferences and susceptibility to others' levels of income or economic achievement (Camerer & Fehr, 2006; Sobel, 2005). A well agreed-upon pathway through which relative income would play a role is through the deleterious effect of *upward* comparisons, whereby relative deprivation or lower position in the socioeconomic hierarchy would decrease well-being and jeopardize health, educational, and social attainments (Ferrer-i-Carbonell & Ramos, 2014; Wilkinson & Pickett, 2007).¹ By contrast, there is scarcer evidence, as well as weaker consensus, around the role of *downward* comparisons. People dislike having less than others, but the existence of a symmetric pathway concerning relative affluence or higher economic status and the way in which this would affect people is contested (Clark & D'Ambrosio, 2015).

Absolute income, relative deprivation, and relative affluence feature are the three facets of economic status in the Fehr and Schmidt (1999) framework of self-centered inequality aversion. So far, the study of the three facets of economic status has been largely circumscribed to experimental or behavioral studies (inter alia, Ellingsen & Johannesson, 2004; Lavergne & Strobel, 2004; Müller & Tan, 2013; Rotemberg, 2008). A much smaller number of studies have investigated the three components of economic status in empirical analyses using large secondary data, with the aim of disentangling the specific relationships between each of the three domains of economic status and social outcomes. These studies use data mostly from high-income countries and cover only dependent variables such as subjective well-being (e.g., D'Ambrosio & Frick, 2012; Ferrer-i-Carbonell, 2005) and job satisfaction (Lundquist, 2008). This is in sharp contrast with the copious literature that has tried to disentangle the role of absolute income and relative deprivation as explanatory variables for a number of social outcomes and across contexts—for example, migration (Antinyan & Corazzini, 2018; Stark & Taylor, 1991), education (Esposito & Villaseñor, 2019), delinquency (Bernburg et al., 2009; Chamberlain & Hipp, 2015), bullying victimization (Napoletano et al., 2016), and a number of health outcomes (Deaton, 2001; Eibner & Evans, 2005; Gravelle & Sutton, 2009).

In this paper, we expand the literature on the joint analysis of upward and downward comparisons using the three domains of economic status to study smoking behavior in a developing country—Mexico. Smoking is a leading cause of preventable mortality and morbidity globally, and although prevalence has declined globally, trends vary considerably across countries (Gakidou et al., 2017; Reitsma et al., 2017). Smoking is strongly influenced by economic status, but while there is generally higher prevalence among less affluent groups, this observation may vary across settings (Carrieri & Jones, 2016; Casetta et al., 2016; Hosseinpoor et al., 2012; Sreeramareddy et al., 2018). Tobacco control interventions rank high on national and international agendas (WHO, 2017), but the evidence on the impact of tobacco control policies on different demographic and socioeconomic subgroups is still poorly understood (Brown et al., 2014; Hill et al., 2014; Over et al., 2014; Parks et al., 2017). Improved understanding of the link between economic status and smoking behavior will help clarify empirical ambiguities as well as design more effective tobacco control policies.

Using a nationally representative health survey from Mexico, we find that the three components in the Fehr and Schmidt (1999) framework are significantly linked to smoking habits. Our results indicate greater smoking at higher levels of absolute standards of living and of relative deprivation, and lower smoking at higher levels of relative affluence. These results are confirmed for five different

smoking outcomes and are robust to alternative indices of relative deprivation and relative affluence as well as to alternative definitions of reference groups. Given the increasing interest in gender differences among socioeconomic drivers of smoking (Amos et al., 2012; Langer et al., 2015), we investigate whether the observed relationships between facets of economic status differ between women and men. We find that our overall results hold for both women and men separately. In addition, interaction terms between gender and the three economic status indicators show significantly stronger associations with smoking prevalence for women.

This paper is organized as follows. Section 2 presents the Fehr and Schmidt's (1999) framework and the Yitzhaki indices of relative deprivation and relative affluence, and discusses the reasons why we hypothesize that each of the three facets of economic status is independently related to smoking habits—including a gender perspective on the issue. Section 3 introduces the data, variables, and econometric approach we use in our empirical analysis. Results are presented in Section 4, and Section 5 concludes.

2 | BACKGROUND

2.1 | The Fehr and Schmidt framework and measures of relative income

Fehr and Schmidt (1999) describe the notion of “self-centered inequality” as follows. An individual experiences “disadvantageous inequality” when comparing herself with individuals who are better-off than her, and she experiences “advantageous inequality” when comparing herself with individuals who are worse-off. Economic status is therefore comprised of three components: own absolute economic achievement, a measure of disadvantage relative to those who are better-off, and a measure of advantage relative to those who are worse-off. These three economic domains are seen as variables playing independent roles in determining individual outcomes.

Formally, let $i = 1, 2, \dots, N$, with $N \geq 3$, denote individuals in society. Let the vector $x = (x_1, \dots, x_N)$ denote society's distribution of an individual economic indicator (typically, income or wealth). Let the Better-off set, $B_i(x) = \{j \in n | x_j > x_i\}$ denote the set of individuals richer than individual i . Similarly, let the Worse-off set, $W_i(x) = \{j \in n | x_j < x_i\}$ denote the set of individuals poorer than individual i . Note that the Better-off and Worse-off sets contain individuals who are, respectively, poorer and richer than individual i , and therefore these sets depend on the society's vector x .

Before introducing the Fehr and Schmidt (1999) equation we lay out the Yitzhaki (1979) indices. These quantify the relative deprivation and relative affluence of individual i , $D_i(x)$, and $S_i(x)$, respectively, as follows:

$$D_i(x) = \sum_{j \in B_i(x)} \frac{x_j - x_i}{N}, \quad (1)$$

$$S_i(x) = \sum_{j \in W_i(x)} \frac{x_i - x_j}{N}. \quad (2)$$

Fehr and Schmidt (1999, p. 822) outline their model by arguing that U_i , the utility of individual i , depends on the three facets of economic status²:

$$U_i(x) = \alpha_a x_i + \alpha_d \cdot D_i(x) + \alpha_s \cdot S_i(x). \quad (3)$$

In Equation 3, the subscript a denotes individual absolute achievement, d denotes individual relative deprivation or disadvantageous inequality, and s denotes individual relative affluence or advantageous inequality. Fehr and Schmidt (1999) suggest that $\alpha_a > 0$ and $\alpha_d, \alpha_s < 0$. Individual utility is positively related to absolute economic achievement and negatively related to the relativistic components. In particular, Fehr and Schmidt posit that $\alpha_d < 0$ because of the frustration arising for being poorer than others, and $\alpha_s < 0$ because fairness concerns may generate a sense of compassion or guilt for being richer than others in society. At the same time, however, they stress that the sign of α_s can be ambiguous; being better off than others may not always induce a sense of guilt, but it may instead foster a sense of accomplishment and be beneficial to the individual—in which case $\alpha_s > 0$.

We use the three facets of economic status envisaged by the Fehr and Schmidt (1999) framework as explanatory variables in regression analysis. This approach has been adopted by Ferrer-i-Carbonell (2005), D'Ambrosio and Frick (2012), Cojocar (2014), Bárcena-Martín et al. (2017), and Leites and Ramos (2018), for whom the dependent variable was subjective well-being, and by Lundquist (2008), who studied job satisfaction.³ They generally observed $\alpha_d < 0$ and $\alpha_s > 0$, although the positive relationship for relative affluence was found to hold for East Germans but not for West Germans by Ferrer-i-Carbonell (2005), was not significant for Cojocar (2014), and was dependent on the functional form used in the analysis for Bárcena-Martín et al. (2017) and for Leites and Ramos (2018). Negative values for α_s , in keeping with the idea of a feeling of guilt for being richer than others, are mainly restricted to the experimental literature (e.g., Rutledge et al., 2016), where participants take part in distributional games where a situation of undeserved advantaged is neatly created by design—although it should be noted that strong evidence of advantage seeking is found by the experimental paper by Cox (2013).

The discrepancy between experimental and survey studies with respect to the sign of α_s can partly be made sense of by considering that in real-life situations the scope for the existence of feelings of guilt for higher economic status is likely to be lower, given the tendency to justify socioeconomic advantage and regard it as deserved and based on merit (see, *inter alia*, Jost & Banaji, 1994; Kleugel & Smith, 1986; McCoy & Major, 2007). Individuals are also more likely to feel compassion for people who are embarking on a joint experience with them (e.g., participating in a game) rather than with the more anonymous population at large—the nature of the relationship among individuals is argued to be particularly important in shaping reactions to downward comparisons (Loewenstein et al., 1989). It should also be noted that upward and downward comparisons involve different neural processes (Güroğlu et al., 2014), and that while negative feelings related to upward comparisons are ubiquitous among humans as well as other social species, feelings related to downward comparisons seem to be circumscribed to humans (Brosnan & de Waal, 2014), and within humans they seem to differ across cultures and at different stages of development across childhood (Blake et al., 2015; McAuliffe, Blake, Steinbeis & Warneken 2017).

2.2 | Literature on economic status and smoking

The literature suggests that smoking is positively related to standards of living in Mexico. Analyzing data from the World Health Survey, Hosseinpoor et al. (2012) found that Mexico is one of the few countries where there is a positive relationship between smoking and standards of living. On the basis of Mexican data, Franco-Marina (2007) found that smoking prevalence and intensity were generally higher among more educated and wealthier individuals; the data also pointed to declining prevalence in smoking among men but rising prevalence in women. Similarly, Corsi and Subramanian (2014) found a greater prevalence of smoking among wealthier strata in India. They interpreted this finding

as indicative of a country that has not transitioned yet to later stages of the tobacco epidemic when health concerns override affordability of smoking among the rich—an interpretation that may well apply to Mexico.

A number of reasons suggest that relative deprivation is a risk factor for smoking (i.e., positively associated). Relative deprivation leads to anxiety and stress related to lower status (Wilkinson, 1997) and psychosocial stressors trigger smoking (Lawless et al., 2015). Interestingly, Slopen et al. (2013) found that among a series of psychosocial stressors positively associated with smoking, an important factor is the degree of perceived inequality—assessed as the dissatisfaction with one's relative position in society in terms of work opportunities, living conditions, and ability to provide for her children. In addition, a positive association between relative deprivation or lower standing in the economic ladder and smoking has been found in several studies (Balsa et al., 2014; Eibner & Evans, 2005; Ling, 2009; Siahpush et al., 2006).

Relative affluence being a symmetric and somehow “opposite” phenomenon to relative deprivation, we expect a negative relationship with smoking. Relative affluence can be hypothesized to be a protective factor for smoking (i.e., negatively associated) through the generation of a sense of accomplishment and appeasement—or, at least, a sense of relief or a shield from psychosocial stress, due to the existence of a “buffer” between you and the bottom of society. This is in keeping with Wills' (1981) theory of downward comparisons, according to which “persons can increase their subjective well-being through comparison with a less fortunate other” (p. 245). This is also in line with the positive relationship between relative affluence and subjective well-being and job satisfaction found in the survey literature referred to earlier, as well as the literature showing that downward comparisons tend to reinforce the promotion of self-interest against others (Anier et al., 2016).

There are marked differences in smoking habits across genders (Pogun et al., 2017; Smith et al., 2016), and we expect the three facets of economic status to play a greater role for women than for men. Higher standards of living are generally associated with female emancipation from traditional gender roles and more equality in the household (Marks et al., 2009), which have been described as important factors for understanding the propensity to smoke of women in Latin America (Regueira et al., 2010). For women, weight control is a strong motivation to smoke (McKee et al., 2006) and higher standards of living increase the importance women attach to slimness and slenderness (Swami, 2015). Evidence from Mexico indicates that at low standards of living females' earnings are almost entirely allocated to cover basic household expenses, while men often keep a share of their earnings for personal purposes (Benería & Roldan, 1987; Bobonis, 2009); it is then reasonable to hypothesize that the availability of resources for personal uses such as smoking increases with standards of living more steeply for women. In addition, women tend to exhibit stronger inequality aversion (Corazzini et al., 2012; Croson & Gneezy, 2009) and are more strongly affected by stress (Bale & Epperson, 2015), which can be triggered by socioeconomic hierarchy, is a risk factor for mental illness (Scott et al., 2014), and can trigger smoking as a consequence (McKee et al., 2003).

3 | EMPIRICAL STRATEGY

3.1 | Data and measures

We use the 2012 Health and Nutrition Survey in Mexico (ENSANUT) conducted by the Mexican National Institute of Public Health. The data are collected from a nationally representative sample of the population selected using a stratified, multistage probability sample design where the 2010

National Census was used as a sampling frame. We use the health and household modules contained in the survey, which provide information on around 45,000 adults, aged 20 and above.

Table 1 provides the survey questions on the outcome variables and the descriptive statistics for each of them. Looking at the variables based on the whole sample (*Smoker* and *HowOld*), 32.18% of our respondents had a significant experience of smoking in their lives (they smoked 100 cigarettes or more), and 18.78% currently smoke; 53.08% never smoked at all, and among those who smoked the large majority had their first smoking experience when they were aged between 13 and 20 years. Focusing on the subsample of respondents who are current smokers, we have three variables indicating smoking intensity in different ways. Looking at the frequency of smoking and the number of cigarettes smoked (*HowOften* and *HowMany*, respectively), 53.36% of smokers smoke daily and 16.65% weekly, with an average of 2.18 cigarettes per day with a standard deviation of 5.19. Finally, *HowSoon* shows that only a minority of smokers are unable to wait 1 hr before smoking the first cigarette of the day.

We measure absolute wealth by computing an asset index on the basis of the rich information offered by the survey on dwelling characteristics (e.g., walls, floors, and roof quality), access to services and utilities (e.g., source of water, garbage disposal, and electricity), and durable goods ownership (e.g., computers, television, and cars)—a total of 38 indicators. We derive our asset index using

TABLE 1 Summary of outcome variables on smoking habits

<i>Dichotomous indicators: Smoker: Have you smoked at least five packs (100 cigarettes) in life? (%)</i>	
No	67.82
Yes	32.18
<i>—Do you currently smoke? (%)</i>	
No	81.22
Yes	18.78
<i>Polytomous indicators: HowOld: How old were you when you first smoked a cigarette? (%)</i>	
Never smoked	53.08
12 years old or younger	5.00
Between 13 and 20 years old	33.54
21 years old or older	8.38
<i>HowOften: How frequently do you smoke? (%)</i>	
At least once a year	2.48
Occasionally	20.92
Monthly	6.59
Weekly	16.65
Daily	53.36
<i>HowMany: How many cigarettes do you smoke per day?</i>	
Mean, Std Dev.	2.18, 5.19
Min, Max	0, 80
<i>HowSoon: How soon after waking up do you smoke your first cigarette? (%)</i>	
More than 1 hr	85.24
Between 31 and 60 min	3.93
Between 6 and 30 min	5.47
First 5 min	5.36

principal component analysis (PCA). As running customary PCA with a large proportion of binary and cardinal variables, as in our data, may yield incorrect results (Howe et al., 2012; Kolenikov & Angeles, 2009), we adopt the methodology proposed by Kolenikov and Angeles (2009) and we run PCA using polychoric correlations.

We measure relative deprivation and relative affluence using the Yitzaki indices D_i and S_i as given in Equations 1 and 2, respectively, and we adopt a geographic criterion for the definition of the reference group (individuals living in the same municipality). Deriving our relative deprivation and relative affluence indices from our asset index is in keeping with the view of Pollack et al. (2007), Laaksonen, Tarkiainen, and Martikainen (2009), and Sweet (2011), who suggest that wealth is a useful variable for the study of socioeconomic gradients in health. In addition, the visible character of assets makes wealth particularly suitable for the construction of indices of relative economic status (Heffetz, 2011; Hicks & Hicks, 2014). Additional details about our asset index and relative indices are provided in the Appendix, Sections I.A.1 and I.A.2. Summary statistics on all explanatory variables are given in Appendix Table A2.

3.2 | Econometric strategy

Our baseline model can be summarized by the following equation:

$$Y_i = \beta_0 + \beta_1 w_i + \beta_2 D_i + \beta_3 S_i + \beta X_i + u_i. \quad (4)$$

The outcome variable (Y_i) is measured using the five variables on different aspects of smoking behaviors seen earlier, and the specific econometric model varies according to the characteristic of the outcome variable. Specifically, we use:

- (i) binary logit models for outcome variable *Smoker* (we report results for the dichotomous outcome “having smoked at least 100 cigarettes” as this indicates a nontrivial experience of smoking, but findings are qualitatively unchanged if we use alternative dichotomous outcomes such as “being a current smoker,” or on “having ever experienced smoking”);
- (ii) ordered logit models for *HowOften* (i.e., how frequently the respondent smokes—daily, weekly, monthly, etc.);
- (iii) Ordinary least squares (OLS) models for *HowMany* (i.e., number of cigarettes smoked per day—results are qualitatively unchanged whether we use the exact number of cigarettes or a concave transformation of it which would lessen the possible influence of outliers)⁴;
- (iv) ordered logit models for *HowSoon* (i.e., how soon after waking up the first cigarette of the day is smoked);
- (v) multinomial logit models for *HowOld* (i.e., the age bracket when the respondent's first smoking experience occurred—“never smoked” is used as base outcome, so that the categories “age 12 or younger,” “between 13 and 20,” and “20 or older” are interpreted with respect to having never smoked).

Moving to explanatory variables, our main regressors of interest are the three economic variables featuring in the Fehr and Schmidt (1999) framework, namely absolute wealth (w_i), relative deprivation (D_i), and relative affluence (S_i). The vector of controls (X_i) includes a gender dummy, age (continuous: years), age squared, level of education (ordinal: none, primary, secondary, postsecondary, tertiary), marital status (categorical: single, free union, married, divorced, widowed), employment status

(categorical: employed, unemployed, retired, student, works at home), household size (continuous: number of people in the household), number of chronic illnesses (continuous: number of long-term illnesses the respondent suffers from), number of limitations in daily activities (continuous: number of actions the respondent is unable to perform on her own), drinking habits (ordinal: does not drink, drinks yearly, monthly, weekly, daily), whether the individual has been a victim of violent events in the past year (dummy) and intensity of depressive symptoms (continuous: 0–21 values from a nationally validated reduced version of the widely used Centre for Epidemiologic Studies Depression Scale CES-D; Radloff, 1977).⁵ In all our estimations, standard errors are clustered at municipal level. Finally, (u_i) is the error term. We run a number of robustness checks employing (D_i) and (S_i) calculated using alternative functional forms as well as reference groups—these checks confirm our results and are available upon request.

4 | RESULTS

4.1 | Main results: Smoking habits and economic domains

Table 2 summarizes the main regression results for each of our five dependent variables—full regression output is provided in Appendix Table A3. The upper panel of Table 2 displays results from logit models for *Smoker* (columns [1]–[3]), ordered logit models for *HowOften* (columns [4]–[6]), OLS models for *HowMany* (columns [7]–[9]), and ordered logit models for *HowSoon* (columns [10]–[12]); the lower panel displays results from a multinomial logit model for *HowOld* where the base outcome is never having smoked (columns [13]–[21]). For each dependent variable, we report three models differing in the progressive inclusion of our three economic indicators: the first model includes only absolute wealth, the second adds relative deprivation, and the third adds also relative affluence in keeping with the full Fehr and Schmidt (1999) framework. Every model includes all control variables.

Across the 21 columns featuring in Table 2, our three economic indicators are consistently significant predictors of smoking behavior (in all cases, $p < .01$). The signs of these variables are as expected, with absolute wealth and relative deprivation being risk factors and relative affluence being a protective factor. When we look at measures of fit, the progressive inclusion of relative deprivation and relative affluence improves the ability of the model to fit the data; this is the case also for the Bayesian Information Factor, which penalizes models for the inclusion of additional regressors (Kass & Raftery, 1995). These results are consistent with evidence in the literature that shows a positive relation of smoking and absolute standard of living in Mexico (Franco-Marina, 2007; Hosseinpoor et al., 2012) and with the argument that relative deprivation triggers or maintains smoking (Eibner & Evans, 2005; Wilkinson, 1997). They also indicate that the adoption of the Fehr and Schmidt's (1999) framework, where, on top of absolute achievement, both the “looking upward” and the “looking downward” aspects of relative achievement are included, better captures the nuances of how economic status relates to smoking behavior.

As can be seen in Appendix Table A3, control variables show reassuring patterns. In all models, gender is significant with a negative coefficient, indicating that, in line with the literature, smoking is less frequent and less intense for women than for men (Pogun et al., 2017; Smith et al., 2016). We observe a positive sign for age and a negative sign for age squared; this appears credible considering that Jha et al. (2002) find that smoking prevalence peaks around age 30–49. Consistent with the results of Zhu et al. (1996), respondents with a university degree or above tend to smoke less compared with those with very low education. Suffering from depression or from a number of chronic illnesses and having been a victim of violent crime tend to be positively associated with smoking—in accordance

TABLE 2 Main regressions for our five outcome variables: summary results

	1) Having smoked 100 cigarettes			2) Smoking frequency			3) No. of cigarettes per day					4) How soon after waking up			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)			
Wealth	0.118*** (0.009)	0.223*** (0.013)	0.252*** (0.015)	0.092*** (0.013)	0.209*** (0.021)	0.258*** (0.025)	0.067*** (0.008)	0.126*** (0.011)	0.139*** (0.014)	0.093*** (0.021)	0.227*** (0.031)	0.303*** (0.038)			
Depriv	0.322*** (0.022)	0.281*** (0.022)	0.281*** (0.022)	0.311*** (0.036)	0.254*** (0.035)	0.254*** (0.035)	0.155*** (0.020)	0.143*** (0.020)	0.143*** (0.020)	0.325*** (0.053)	0.291*** (0.057)	0.291*** (0.057)			
Satisf			-0.151*** (0.024)			-0.253*** (0.048)				-0.064** (0.026)		-0.306*** (0.077)			
Female	-1.43*** (0.044)	-1.45*** (0.044)	-1.45*** (0.044)	-0.28*** (0.066)	-0.32*** (0.066)	-0.34*** (0.066)	-0.30*** (0.033)	-0.32*** (0.033)	-0.32*** (0.033)	-0.41*** (0.102)	-0.45*** (0.102)	-0.46*** (0.102)			
N	44,370	44,370	44,370	8,556	8,556	8,556	8,487	8,487	8,487	8,556	8,556	8,556			
LL	-23,152	-22,987	-22,959	-10,346	-10,299	-10,277	-12,929	-12,894	-12,890	-4,688	-4,667	-4,653			
BIC	46,594	46,273	46,228	20,963	20,879	20,843	26,103	26,042	26,043	9,639	9,605	9,588			

	5) Age of first cigarette ("Never smoked" as base outcome)										
	12 years old or younger					Between 13 and 20 years old			21 years old or older		
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)		
Wealth	0.121*** (0.014)	0.254*** (0.021)	0.291*** (0.024)	0.126*** (0.009)	0.222*** (0.014)	0.253*** (0.016)	0.066*** (0.012)	0.135*** (0.018)	0.158*** (0.020)		
Depriv	0.400*** (0.039)	0.400*** (0.039)	0.345*** (0.039)	0.304*** (0.026)	0.304*** (0.026)	0.254*** (0.026)	0.219*** (0.035)	0.219*** (0.035)	0.178*** (0.035)		
Satisf			-0.210*** (0.048)			-0.169*** (0.028)			-0.136*** (0.038)		
Female	-2.39*** (0.088)	-2.42*** (0.088)	-2.42*** (0.088)	-1.69*** (0.047)	-1.71*** (0.048)	-1.72*** (0.047)	-0.68*** (0.054)	-0.71*** (0.053)	-0.71*** (0.053)		
N	44,240	44,240	44,240	44,240	44,240	44,240	44,240	44,240	44,240		
LL	-39,726	-39,564	-39,527	-39,726	-39,564	-39,527	-39,726	-39,564	-39,527		
BIC	80,318	80,026	79,984	80,318	80,026	79,984	80,318	80,026	79,984		

Note: Clustered errors at municipal level in parentheses. *** denotes $p < .01$, respectively. All regressors included.

BIC: Bayesian Information Factor.

with the idea that smoking may be triggered by stressful events, as argued earlier. The literature typically finds a positive correlation between smoking and drinking (Bien & Burge, 1990)—our results confirm this pattern for heavy drinkers but not for moderate drinkers. Finally, being married and being divorced are, respectively, negatively and positively associated with smoking—although only for some outcome variables.

On the basis of column (3) we produce Figure 1, which shows predicted probabilities and marginal effects for the probability of having smoked at least 100 cigarettes over the domain of our three economic indicators. The curves for absolute wealth and for relative deprivation have an upward slope, and marginal effects are positive with confidence intervals not overlapping with zero. Relative affluence exhibits a downward slope and negative marginal effects that again are significant over the whole domain. These curves also suggest that the probability of having smoked at least 100 cigarettes changes at fairly constant rates over relative deprivation domain, while there is evidence of increasing rate of change in the case of absolute wealth and (moderate) decreasing rate of change in the case of relative affluence. The predicted probability curves also enable a visual appreciation of the magnitudes of the relationships between smoking behavior and economic domains. We quantify exact predicted probabilities of having smoked at least 100 cigarettes for respondents at the 5th, 50th, and 95th percentiles of absolute wealth (who have wealth figures of 2.96, 7.04, and 10.16, respectively), and find that these are 17.57%, 32.73%, and 47.13%, respectively. Predicted numbers of cigarettes for these respondents, on the basis of model (9), are 2.61, 5.39 and 7.53, respectively. The preceding results are qualitatively unchanged for female and male subsamples (results available upon requests).

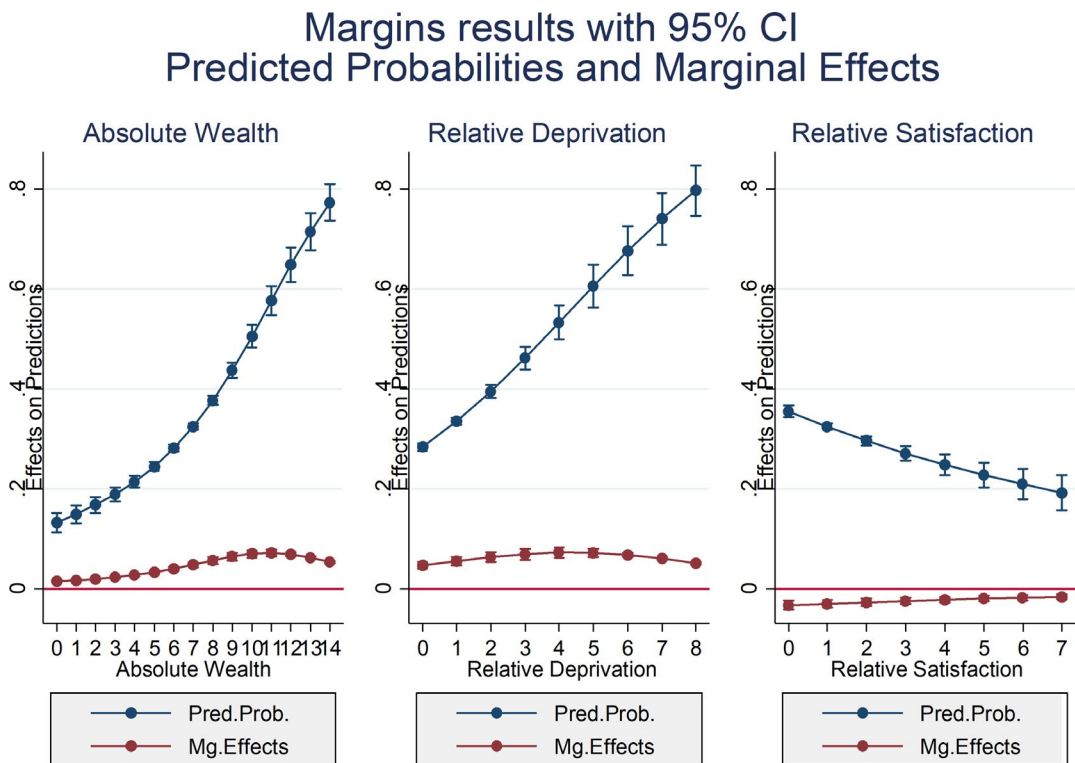


FIGURE 1 $\Pr(\text{Smoker} = 1)$ along the domains of x_i , D_i , and S_i . 886 × 650 mm (96 × 96 DPI) [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 3 Gender differences: summary results

	1) Having smoked 100 cigarettes	2) Smoking frequency	3) No. of cigarettes per day	4) How soon after waking up
	(3g)	(6g)	(9g)	(12g)
Abs Wealth	0.158*** (0.016)	0.250*** (0.026)	0.141*** (0.014)	0.313*** (0.041)
Female*Wealth	0.297*** (0.025)	0.045 (0.054)	-0.008 (0.025)	-0.057 (0.072)
Rel Depriv	0.206*** (0.026)	0.257*** (0.039)	0.146*** (0.022)	0.275*** (0.065)
Female*Depriv	0.260*** (0.043)	0.001 (0.094)	-0.026 (0.045)	0.073 (0.140)
Rel Satisf	-0.103*** (0.028)	-0.234*** (0.048)	-0.079** (0.031)	-0.341*** (0.089)
Female*Satisf	-0.163*** (0.046)	-0.083 (0.089)	0.046 (0.043)	0.157 (0.134)
Female	-3.735*** (0.194)	-0.601 (0.446)	-0.293 (0.215)	-0.242 (0.616)
<i>N</i>	44,370	8,556	8,487	8,556
LL	-22,832	-10,276	-12,889	-4,652
BIC	46,007	20,869	26,067	9,612
5) Age of first cigarette ("Never smoked" as base outcome)				
	12 years old or younger	Between 13 and 20 years old	21 years old or older	
	(15g)	(18g)	(21g)	
Abs Wealth	0.184*** (0.026)	0.114*** (0.019)	0.004 (0.027)	
Female*Wealth	0.217*** (0.057)	0.329*** (0.025)	0.272*** (0.033)	
Rel Depriv	0.276*** (0.046)	0.157*** (0.034)	0.067 (0.050)	
Female*Depriv	0.150 (0.096)	0.260*** (0.046)	0.214*** (0.067)	
Satisf	-0.138** (0.056)	-0.098*** (0.035)	-0.023 (0.055)	
Female*Satisf	-0.175* (0.102)	-0.169*** (0.044)	-0.197*** (0.069)	
Female	-3.929*** (0.453)	-4.184*** (0.197)	-2.624*** (0.269)	
<i>N</i>	44,240	44,240	44,240	
LL	-39,349	-39,349	-39,349	
BIC	79,725	79,725	79,725	

Note: Clustered errors at municipal level in parentheses. *, **, and *** denote $p < .1$, $p < .05$, and $p < .01$, respectively. All regressors included.

BIC: Bayesian Information Factor.

Finally, we address the issue of multicollinearity, which is a potential concern because absolute and relative economic indicators are bound to be rather highly correlated—in our case, correlations are -0.69 for (w_i) and (D_i) , 0.70 for (w_i) and (S_i) , and -0.66 for (D_i) and (S_i) . The high significance of the three variables is a first suggestion that collinearity may not be a problem. This indication is strengthened by the fact that the sequential introduction of relative deprivation and relative satisfaction does not alter significance levels or trigger switches in coefficient signs. This is also the case when we extend the stepwise regression procedure further, applying it to a number of other potentially related variables such as education (results available upon request)—in fact, there is no qualitative change in results if any of the covariates are dropped. Variance inflation factor (VIF) statistics provide further reassurance, since figures for the three economic variables never exceed 4 and overall mean VIF never exceeds 5—the only variables having high VIF are as expected age and age squared.

We next test whether there is a significant difference in the predictive role of the three economic domains between women and men. We do this by estimating Equation 5, which includes interaction terms between each of our three economic variables and the dummy for female (F):

$$Y_i = \beta_0 + \beta_1 w_i + \beta_2 (F) (w_i) + \beta_3 D_i + \beta_4 (F) (D_i) + \beta_5 S_i + \beta_6 (F) (S_i) + \beta X_i + u_i. \quad (5)$$

Table 3 summarizes the main regression results for each of our five dependent variables—full regression output is provided in Appendix Table A4. Results show significant gender differences for the two outcomes related to smoking prevalence and specified over the whole sample, that is, *Smoker* and

Margins results with 95% CI Predicted Probabilities and Marginal Effects

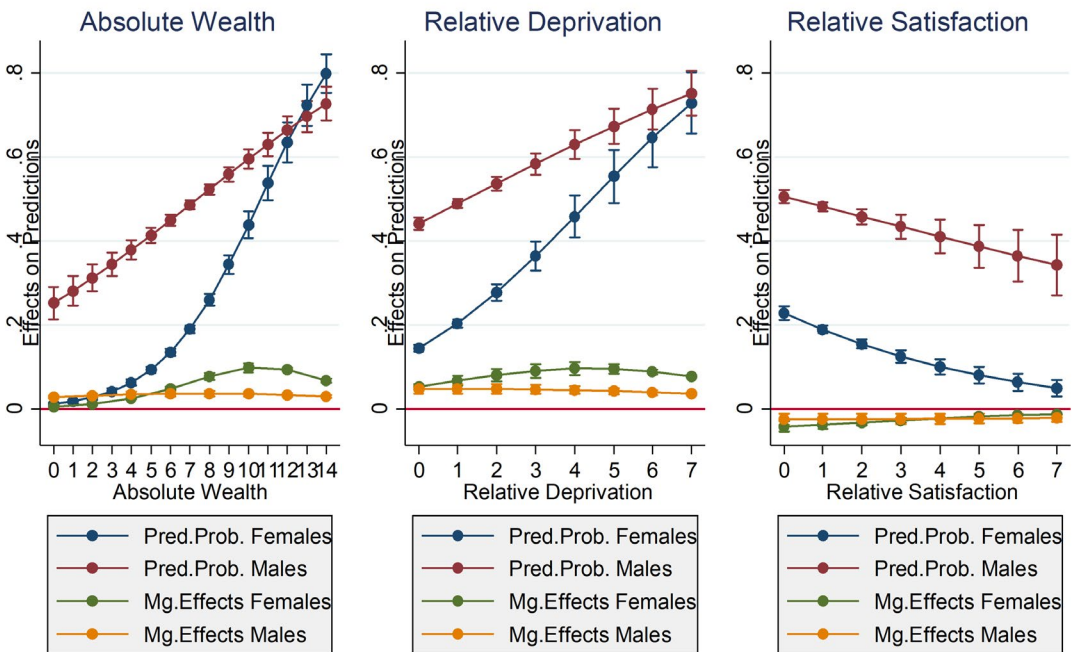


FIGURE 2 $\Pr(\text{Smoker} = 1)$ along the domains of x_i , D_i , and S_i by gender. 886 × 650 mm (96 × 96 DPI)
[Colour figure can be viewed at wileyonlinelibrary.com]

HowOld—that is, regressions (3g) and (18g). The sign of the interaction term is the same as the sign of the economic status variables, indicating that the associations between economic status indicators and the probability of experiencing smoking (positive for absolute wealth and relative deprivation and negative for relative affluence) are heightened for women. In Figure 2, we plot predicted margins and marginal effects for women and men on the basis of model (3g). For both genders, slopes of predictive margins are positive for absolute wealth and relative deprivation and negative for relative satisfaction, and again marginal effects are significant. Yet, the absolute wealth and relative deprivation curves are remarkably steeper for women—because of which gender differences are greatest at low values and tend to vanish at high values. With regard to the relative affluence curve, the slope is again steeper for women although the difference is in this case less appreciable. The observed gender heterogeneity is in line with our hypotheses. The stronger link between absolute wealth and smoking for women can be explained on the basis of more modern socialization patterns, female emancipation, and social acceptability of female smoking for wealthier women. The results for relative standards of living tally with our earlier discussion of stress being pathway through which relative deprivation has been argued to trigger smoking and being more prevalent among women. It should be noted that gender differences are, however, not found in the case of outcomes related to smoking intensity (*HowMany*, *HowOften*, and *HowSoon*).

5 | CONCLUSION

In this paper, we used the three facets of economic status featuring in the Fehr and Schmidt (1999) framework as explanatory variables for an array of outcome variables related to smoking behavior—for the first time extending the joint study of upward and downward comparisons beyond subjective well-being outcomes. Using a large representative Mexican health survey, we found robust evidence that absolute wealth and relative deprivation are risk factors, while relative affluence is a protective factor for smoking. Disentangling the potential role of absolute and relative standards of living is an important task for the study of health outcomes, since it enables a better understanding of the mechanisms related to economic affluence and economic inequality.

Our work has implications for policy and for further research. While Mexico has recently strengthened tobacco control policies, much remains to be done. The successful implementation of the Framework Convention for Tobacco Control recommendations may avoid 470,000 preventable deaths in Mexico during the next four decades (Fleischer et al., 2017). Understanding the socioeconomic drivers of smoking is key to this aim, in particular for an upper-middle income country like Mexico where national and sub-national indicators of inequality are strikingly high (OECD, 2016). Studying whether the relationships identified for Mexico using the Fehr and Schmidt framework are similar in other settings is an important task for future research, as is monitoring whether these relationships will hold at different phases of Mexico's epidemiological transition. Our evidence is also important given the predicted sharp increase in female tobacco users by 2025 (WHO, 2010) and given the differences across genders in the effectiveness of tobacco policies (Kuipers et al., 2014). Future research should also go beyond our cross-sectional study and use panel data to explore the causal nature of the relationships we found.

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DATA AVAILABILITY STATEMENT

The data were collected by the Mexican National Institute of Public Health and are freely available at: <https://ensanut.insp.mx/encuestas/ensanut2012/index.php>.

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ENDNOTES

- ¹ The main exception to this is the so-called tunnel effect (Hirschman & Rothschild, 1973; Ravallion & Lokshin, 2000; Senik, 2004), where, in a dynamic perspective, individuals may consider others' economic gains as signals that living conditions will be soon improving also for them.
- ² It should be noted that Fehr and Schmidt (1999) did not relate their relativistic components directly to the Yitzhaki indices, although formally the difference is only in the normalization by the reference group size—which is N in the Yitzhaki indices and $(N - 1)$ in for Fehr and Schmidt. We also added α_n for expositional purposes.
- ³ D'Ambrosio and Frick (2012) propose a generalization of Equation 1, which accounts for the dynamic aspects of both relative deprivation and relative satisfaction (see their equation 7, p. 289).
- ⁴ See Mullahy (1997) for alternative estimation approaches based on Poisson models where the dependent variable is packs of cigarettes smoked (i.e., number of cigarettes divided by 20).
- ⁵ We follow Tampubolon and Hanandita (2014) and quantify the intensity of depressive symptoms by simply summing up the CES-D scores.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.

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