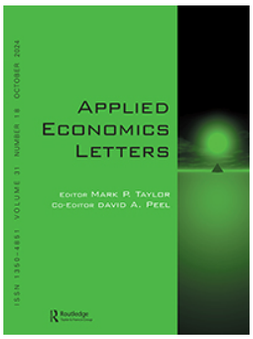

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Does a Kuznets curve exist for tobacco consumption? Evidence from OECD countries

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ABSTRACT

Using data from 27 OCDE countries from 1990 to 2021, the purpose of this article is to study empirically if the Kuznets' curve hypothesis exists on economic development and health, measuring the latter through tobacco consumption. We examine the relationship between tobacco consumption and income, the Gini coefficient, life expectancy, unemployment rate, and the population's age structure to analyse the research question given the relevance to economic development and costs of tobacco use. We hypothesize that tobacco consumption increases as income levels increase until a certain tipping point, after which tobacco consumption would start to fall. We provide evidence for the existence of a Kuznets Curve for tobacco consumption. Our results also verify that inequality, unemployment rates and life expectancy increase tobacco consumption, although increases in the youth and the elderly population reduce tobacco use.

KEYWORDS

Tobacco consumption; Kuznets curve; economic development; income; health

JEL CLASSIFICATION

I10; I18; O10

I. Introduction

The classical Kuznets curve was tested by Simon Kuznets (1955), analysing the hypothesis of a quadratic relationship between income inequality and economic development. Decades later, the Environmental Kuznets Curve (EKC) emerged with Grossman and Krueger (1995), examining the association between environmental quality and income as an inverted-U. On this basis, environmental quality initially worsened but ultimately improved as income levels increased.

The literature applying health indicators to the Kuznets curve has been growing but remains limited. Gangadharan and Valenzuela (2001) proved that environmental stress negatively impacts on health according to the EKC. Studies looking at Body Mass Index (BMI) and calorie intake have found no evidence of a Kuznets curve or obesity (Grecu and Rotthoff 2015; Talukdar et al. 2020), while Molini, Nube, and van den Boom (2010) analysed the correlation between the Human Development Index and the concentration index of BMI, finding an inverted-U association. Similarly, Costa-Font, Hernandez-Quevedo, and Sato (2018) concluded that economic development reduces income related-health inequalities, fitting a Kuznets' curve. Moreover, Cantarero, Pascual, and Gonzalez (2019) tested that alcohol use is influenced by income, finding an 'alcohol consumption Kuznets curve'. More recently, Nagano et al. (2020) examined the relationship between income, measured as Gross Domestic Product (GDP) per capita, and population's blood pressure, showing a trend similar to a 'Heart Kuznets Curve'.

We aim to make contributions to the prior literature on the relationship between income and health. Given the relevance to economic development and the high health and economic costs of tobacco use, we investigate whether the association between income and tobacco consumption follows a trend like a Kuznets Curve, hypothesizing that tobacco use increases as income levels increase until a certain tipping point, after which tobacco consumption would start to fall. Our findings add to the already limited strand of the literature regarding the link between income (through GDP) and tobacco consumption.

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II. Materials and methods

To identify the relationship between income and tobacco consumption, we use an unbalanced panel from 1990 to 2021 for a sample of 27 countries (Australia, Austria, Belgium, Canada, Costa Rica, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Japan, Korea, the Netherlands, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States), collecting data from the OECD Health Data (2022). To test our hypothesis, we include tobacco consumption (grams per person aged 15 years and more) as the dependent variable. The association of the health outcome with the country's level of economic growth is analysed using the country's nominal GDP per capita in constant 2000 prices, measured in US dollars. The gap between the rich and the poor is measured by the Gini coefficient (a statistical measure of inequality based on the disposable income, post taxes and transfers in the country) (following Grecu and Rotthoff 2015). A health variable used is life expectancy, which is a popular indicator of health although it is not without problems. In addition, a labour variable such as unemployment rate is also chosen, and population structure is controlled by both the elderly (population aged 65 years and over) and youth (population aged under 24 years) ratios (following Cantarero, Pascual, and Gonzalez 2019). The summary statistics of these variables are presented in Table 1.

To estimate the relationship between income and tobacco consumption, we estimated a fixed effects model (Baymul and Sen 2020). The regression can be summarized as follows:

$$Y_{it} = \beta_1 inc_{it} + \beta_2 inc_{it}^2 + \delta X' + \theta_i + w_t + \varepsilon_{it} \quad (1)$$

where Y_{it} indicates the tobacco consumption; inc_{it} refers to GDP as a measure of economic development which is hypothesized to follow a quadratic relationship (inc_{it}^2); X' are variables that directly influence tobacco consumption; θ_i refers to country effects; w_t refers to time effects; and ε_{st} is the error term. A notation list is included in the Supplementary Material (Table A.1.).

From this specification, the inverted-U shaped Kuznets Curve can be identified whether β_1 is positive and β_2 is negative. Moreover, the coefficients of the estimated variables will indicate if income and other socio-economic variables play an important role in tobacco consumption as negative lifestyle behaviours.

However, before carrying out the above-mentioned model estimation, preliminary tests were carried out to detect the properties of the variables considered in the empirical analysis, following Fuinhas et al. (2021). The results of these tests are shown as Supplementary Material. In addition, a conceptual framework describing the methodological approach used in this study is shown (see Figure A.1).

The empirical analysis was carried out using Stata 16 software. Moreover, this study had used the following commands: *sum*, *sktest*, *swilk*, *vif*, *xtcd*, *multipurt*, *xtcointtest westerlund*, *hausman*, and *xtreg*.

III. Results

Table 2 shows the results of the estimated Tobacco Consumption Kuznets curve. Equation (1) is estimated in three specifications as follows: Model (1) uses data on income, income squared, the Gini coefficient and unemployment rate; Model (2) includes life expectancy variable to

Table 1. Summary statistics.

Variable	Obs.	Mean	SD	Min	Max
Dependent variable					
Tobacco consumption	675	1697.534	685.610	108.000	3741.000
Independent variables					
Income (GDP per capita - US$)	857	37712.225	12856.301	9391.169	99319.449
Gini coefficient	328	0.309	0.053	0.2110	0.497
Life expectancy (years)	854	78.866	3.063	67.500	84.700
Unemployment rate	668	7.068	3.869	2.014	27.468
Youth ratio (population aged under 24 years)	864	32.578	6.321	21.216	54.785
Elderly ratio (population aged 65 years and over)	864	14.680	4.009	4.375	28.855

Table 2. Impact of GDP per capita and other explanatory variables on tobacco consumption for a sample of 27 OECD countries.

Variable	Model (1)		Model (2)		Model (3)	
Dependent variable (tobacco consumption)						
Income	0.001	***	0.001	***	0.001	***
	(0.000)		(0.000)		(0.000)	
Income squared	−0.001	***	−0.001	***	−0.001	**
	(0.000)		(0.000)		(0.000)	
Gini coefficient	6.936	***	5.825	***	4.333	***
	(1.372)		(1.468)		(1.635)	
Unemployment rate	0.149	***	0.145	***	0.121	**
	(0.043)		(0.047)		(0.054)	
Life expectancy			0.134		0.320	
			(0.243)		(0.381)	
Youth ratio					−0.492	**
					(0.227)	
Elderly ratio					−0.896	***
					(0.268)	

Notes: Robust standard error is indicated in parenthesis. *, ** and *** represent significant variables at 10%, 5% and 1%, respectively.

Model (1); and Model (3) adds youth and elderly population ratios to Model (2). In all specifications, the dependent variable is tobacco consumption.

It is seen that the estimated models indicate the evidence that economic development and tobacco consumption in the 27 OECD countries considered follow a similar pattern to that described by the Kuznets' curve. We find positive coefficients for the GDP per capita and negative coefficients for the quadratic form of income, suggesting an inverted U-shaped relationship.

All specifications reveal similar results, and most estimates are highly statistically significant (except for life expectancy). We observe positive coefficients for the Gini variable, indicating that reducing inequalities between the rich and the poor is associated with increased tobacco consumption. All the coefficients for unemployment rate are positive, indicating that increased unemployment is associated with increased tobacco consumption. Thus, tobacco consumption is aggravated for unemployed individuals. The estimated coefficient of the life expectancy is positive for all specifications, contrary to what was expected because it indicates that the longer the life expectancy, the higher the tobacco use. The effect of the population's age structure on tobacco consumption (Models 1–3) indicates that youth and elderly population are both inversely related to tobacco consumption. Hence, increases in the youth and the elderly reduce tobacco use.

IV. Discussion

This research examines the existence of a Tobacco Consumption Kuznets' curve. Our results add to the literature on the association between economic development (GDP per capita) and health indicators (tobacco consumption), supporting the Kuznets' curve hypothesis and suggesting that tobacco consumption decreases beyond a certain level of income as happened with other health indicators (Molini, Nube, and van den Boom 2010; Nagano et al. 2020). Besides, we find that inequality, unemployment rates and life expectancy increase tobacco consumption, although increases in the youth and the elderly population reduce tobacco use.

It is important to note the limitations of this study: (1) using certain economic, demographic and health variables, (2) missing data, (3) considering 27 OCDE countries and data from 1990 to 2021, or (4) differences in socioeconomic status between groups of people within countries. Future studies would usefully address these limitations: (1) the period can be extended, (2) future studies could involve other independent variables or using other proxies of economic development, which would be interesting to extend the empirical analysis to verify and test the EKC hypothesis using other health outcomes different than those discussed.

Despite these limitations, the gap in the literature regarding the Kuznets curve and tobacco consumption suggests that findings generated from this empirical analysis will shed new light on the

topic. Specifically, these results could help on the need to achieve health public policy goals, highlighting that policymakers need to explore health education to avoid the Tobacco Consumption Kuznets curve which is expected to help modify the habits and lifestyles of the population, focusing on the prevention of tobacco consumption.

Disclosure statement

No potential conflict of interest was reported by the authors.

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