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Short Communication

What is the association between price and economic activity with cigarette consumption in Cuba from 1980 to 2014?



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ABSTRACT

Objectives: Cuba is a tobacco-producing country that has been economically isolated as a consequence of an embargo imposed by the USA. It has also experienced a severe economic depression in the 1990s after the withdrawal of support by the former Soviet Union. These characteristics provide a unique opportunity to study the relation between large changes in economic activity, cigarette price and demand for cigarettes in a relatively isolated socialist economy.

Study design: This is an observational epidemiological study.

Methods: Data were obtained on the annual price of a packet of cigarettes and the mean number of cigarettes consumed per adult living in Cuba from 1980 to 2014. Descriptive and regression analysis were used to explore the relationship between cigarette consumption and price in Cuba. **Results:** In 1980, the mean price of a packet of cigarettes was 1.53 Cuban peso (CUP) in 1997 prices and the mean annual *per capita* consumption was 2237 cigarettes. In 2014, the mean price had increased to 5.57 CUP (1997 prices) per packet of cigarettes, and consumption had fallen to 1527 cigarettes *per capita*. There were significant negative associations between annual cigarette consumption and both price and living through an economic depression. The elasticity was approximately -0.31 with price, and living through an economic depression was also associated with lower consumption of cigarettes (a reduction of 9%, 95% confidence intervals -0.18 to -0.001).

Conclusions: Higher cigarette pricing, along with other public health interventions, are required to protect the national population from the adverse effects of tobacco smoke exposure.

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Smoking increases mortality, and over 10% of global deaths are a consequence of tobacco exposure.¹ Population interventions to reduce smoking are, therefore, public health priorities. National governments have the capacity to increase the price of cigarettes by taxation, and this is a very efficient method of decreasing demand.² Developing the evidence base of the association between the price of cigarettes and their consumption is important in implementing effective antitobacco fiscal policy.

Cuba has been governed by a socialist government since 1959, and population health is a national priority.³ Cuba is also a tobacco producer and, as a consequence of its island geography and an economic embargo by the USA since the 1960s,⁴ is unlikely to have experienced a high level of cigarette smuggling. We have used data from Cuba to explore the association between annual cigarette price and consumption from 1980 to 2014. This includes a period of recent history known as the ‘special period’ that spanned a severe economic depression when the Soviet Union withdrew economic support for Cuba in the 1990s resulting in a decrease of gross national product (GNP) to 36% lower than the 1990 baseline value.⁵ We were thus able to explore the association of these relatively unique economic changes with annual *per capita* cigarette consumption.

Data on the annual mean price of a packet of 20 cigarettes and annual cigarette consumption *per capita* of individuals aged 15 and older were obtained for the years 1980 and 1985 and then annually from 1991 to 2014 from the Cuban Office of Statistics,⁶ the official government statistical agency. Data on *per capita* gross domestic product (GDP) and the GDP deflator were obtained from the World Bank. We used *per capita* GDP as a proxy for *per capita* income. All prices were deflated using the GDP deflator and are expressed in 1997 prices. Data on the national smoking prevalence rate for adults was obtained from the Cuban National Health Surveys.

Descriptive and regression analysis were used to explore the relationship between cigarette consumption and price in Cuba. We first plotted the data to examine the covariability of consumption and price and how this changes over time. An ordinary least squares (OLS) regression was used to quantitatively determine the impact of a change in the price of cigarettes on cigarette consumption, using a demand function of the form:

$$\ln Q_t = \alpha + \beta_1 \ln P_t + \beta_2 \ln Y_t + \varepsilon_t \quad (\text{Eq. 1})$$

where subscript *t* denotes the time period; $\ln Q$ is the logarithm of *per capita* cigarette consumption; $\ln P$ is the logarithm of the annual average real price of a packet of cigarettes; $\ln Y$ is the logarithm of real *per capita* income and ε is a random error term.

The prevalence of smoking for individuals aged 15 years or older was 37% in 1995, 32% in 2001 and 24% in 2011. In 1980, the price of a packet of cigarettes was 1.53 CUP (1997 prices) and the mean annual *per capita* consumption was 2237 cigarettes. In 2014, the price of a packet of cigarettes had increased to 5.57 CUP (1997 prices) and mean annual consumption had decreased to 1527 cigarettes per year.

Fig. 1 shows the relationship between consumption and the price of cigarettes between 1980 and 2014. There is a clear

initial inverse association between cigarette pricing and consumption which reached a minimum of 1196 cigarettes in 1997 after the end of a sustained period of economic crisis. Since then, mean cigarette consumption has increased, despite annual increases in price.

OLS estimates of the cigarette demand function are presented in Table 1. We present results for the whole sample and then separately for the period during and after the period of economic crisis. The signs on the regression coefficients of the independent variables are as expected across all sample periods. The regression coefficient on price is negative and significant, while *per capita* income has a positive (albeit weakly significant) effect on consumption. In column (2), we replaced *per capita* income with a dummy variable for the special period, the period of economic depression which lasted from 1991 until 1998,⁵ and find that this period was associated with a reduction of 9% in cigarette consumption (95% confidence intervals -0.18 to -0.001).

The results indicate that the price elasticity of demand for cigarette consumption was around -0.31 for the period as a whole. In other words, a 10% increase in the price of cigarettes was associated with a 3.1% decline in consumption. It should, however, be noted that there is significant variability in this value over the sample period. Columns (3) to (5) show that during the period of economic depression cigarette consumption became less responsive to a change in price (here price is weakly significant with a *P*-value of 0.14); between 1999 and 2004, price had no significant effect on consumption, whereas from 2004 onwards, the price elasticity of demand was elastic (i.e. demand responds more than proportionately to a change in price).

This analysis of data from Cuba explores the impact of cigarette pricing on consumption at the population level over a period spanning four decades. As the Cuban state is the sole producer of cigarettes on the island and there are no substantial tobacco imports, we are confident that our official national data will capture most of the cigarettes consumed. The data show a large drop in annual *per capita* cigarette

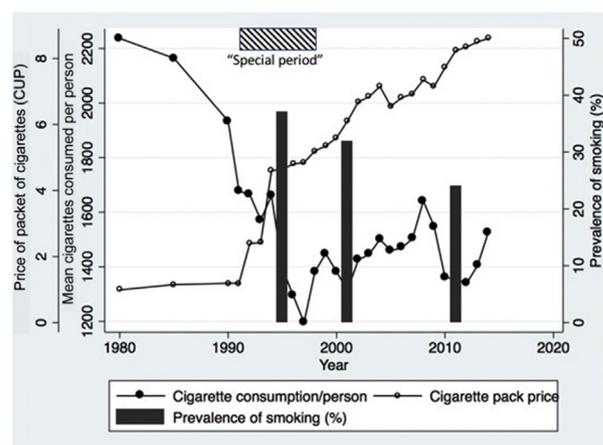


Fig. 1 – The association between cigarette price and consumption in Cuba from 1980 to 2014. The ‘special period’ represents the period of severe economic depression from 1991 to 1998.

Table 1 – Ordinary least squares estimates of cigarette consumption.

Variable	(1)	(2)	(3)	(4)	(5)
Period of analysis	All	All	Special period	1999–2004	2005–2014
$\ln P_t$	−0.307*** (0.041)	−0.305*** (0.038)	−0.320 (0.183)	−0.313 (0.913)	−1.096* (0.562)
$\ln Y_t$	0.098 (0.062)	−0.006 (0.078)	−0.426 (0.592)	0.640 (1.094)	0.043 (0.205)
Special period		−0.090** (0.044)			
Constant	6.992*** (0.484)	7.850*** (0.618)	11.031* (4.742)	2.758 (7.164)	8.802*** (1.525)
Observations	27	27	8	6	10
R-squared	0.706	0.751	0.403	0.185	0.386

Standard errors in parentheses.
 $\ln Q$ = logarithm of *per capita* cigarette consumption; $\ln P$ = logarithm of the annual average real price of a packet of cigarettes; $\ln Y$ = logarithm of real *per capita* income; subscript *t* denotes the time period.
 ****P* < 0.01, ***P* < 0.05, **P* < 0.1.

consumption from 1980 to 1997 which was inversely associated with cigarette price. Similar decreases in prevalence of cigarette smoking were also observed over the same time period. The period of economic depression was also independently associated with a decrease in cigarette consumption. Since the end of the special period, however, tobacco consumption has increased and subsequently stabilised at 28% above the minimum level, despite annual increases in price.

The strengths of these data are the unique geographical and political nature of Cuba that permits confidence that there is little smuggling of tobacco to distort these data. The main manufactured products of high value for Cuban tobacco that are likely to be smuggled are cigars, which are not included in this analysis for this reason. Similarly, pricing is centrally determined in a command economy, and hence, it is unlikely that there will be substantial variations in price across the island. Data were only available on mean prices, and hence, we were unable to examine variation between brands. Some individuals may roll their own cigarettes, and this is one source of cigarettes that is not included in our data, thus representing a limitation of our analysis.

It is worth noting that as a consequence of the socialist nature of the economy providing a basic level of essential goods to the nation, each Cuban receives a weekly ration of goods. This initially included 80 cigarettes/month for adults, and Cubans aged 55 years and older continued to receive this number of cigarettes at a subsidised price until 1st September 2010. These free or subsidised cigarettes will have been less sensitive to pricing, and hence, removing this system of free or subsidised cigarettes will undoubtedly have impacted on tobacco consumption.

There is a clear inverse association between cigarette price and consumption.² This may vary according to the cost of cigarettes relative to the economy, or their affordability. Cigarette consumption dropped initially by 46% from 1980 to 1997, an association that was inversely associated with price. However, between 1991 and 1995, GNP decreased by 36%, resulting in a period of severe hardship during which, although cigarette manufacture for national consumption continued, consumption of many commodities fell. The lowest year of cigarette consumption was in 1997 when the economy was recovering from these external events, and the increase since suggests that economic activity remains an

important determinant of tobacco consumption, as they become relatively more affordable.

Per capita consumption of tobacco in Cuba has increased since 1997 by approximately 28% in 2014 despite annual increases in tobacco price. These data suggest that increase in cigarette pricing is one option that may have a beneficial impact on both government revenue and national well-being in Cuba. Indeed further, analysis reveals that the price elasticity of demand for cigarettes is −0.31, which is compatible with other Latin American and Caribbean countries.⁷ However, to reduce the cigarette smoking prevalence quickly, a broad range of national level interventions are also required, as detailed in the Framework Convention of Tobacco Control agreement that has been signed by Cuba in 2004, but not yet ratified.⁸ Smoking remains a public health priority for Cuba as 18% of all preventable deaths were attributable to cigarette consumption in 2007,⁹ and recent smoking prevalence in 2014 was approximately 19% in adults.¹⁰

In summary, we present data from Cuba demonstrating that cigarette consumption was inversely associated with price, with a further substantial decrease during a period of severe economic depression. As these are both facets of relative affordability, higher price increases in the form of increased taxation would be likely to be beneficial for the health of the Cuban people and also increase taxation revenue for the Ministry of Finance.

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Ethical approval

No ethical approval required as the analysis used summary statistics from national agencies, with no individual patient level data.

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Competing interests

None declared.

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