



## RESEARCH ARTICLE

# Visualizing data: Trends in smoking tobacco prices and taxes in India [version 1; peer review: 3 approved, 1 approved with reservations]

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## Abstract

**Background:** Tobacco smoking remains a leading risk factor for disease burden globally. In India alone, about 1 million deaths are caused annually by smoking. Although increasing tobacco prices has consistently been found to be the most effective intervention to reduce tobacco use, the documentation of prices and taxes across time and space has not been an essential component of tobacco control surveillance in most jurisdictions. This study aimed to examine, using graphical methods, trends in smoking tobacco taxes and prices in India at national and state-level.

**Methods:** We used retail prices, price indices, and unit values (household expenditures on a commodity divided by the quantity purchased) collected and reported by government agencies. For bidis and cigarettes, we examined current and real (inflation-adjusted) prices, affordability (cost in terms of income), and key tax changes at both national and state-level.

**Results:** We show that real prices of bidis and cigarettes were relatively flat (even decreasing in the case of bidis) between 2000 and 2007, and clearly increasing from 2010. When rising income is taken into account, however, both cigarettes and bidis have become more affordable since 2000. We found that some but not all tax changes were accompanied by price changes and in particular, that tax decreases did not result in price decreases.

**Conclusion:** It is feasible to evaluate tax and price policies at national and regional level using routinely collected data.

## Keywords

smoking, tobacco, cigarette, bidi, India, price, tax, data visualization

## Open Peer Review

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## Introduction

For more than three decades, tobacco smoking has remained a leading risk factor for premature mortality globally<sup>1,2</sup>. While tobacco-attributable deaths are predicted to decline in high-income countries, they are predicted to double from 3.4 million to 6.8 million in low- and middle-income countries<sup>3</sup>. In India, despite modest decreases in the prevalence of tobacco smoking (i.e., bidis<sup>1</sup> and cigarettes), the number of male smokers aged 15–69 years has increased substantially over the last 15 years, with a current population of more than 100 million adult smokers<sup>4</sup>. About 1 million Indians are killed by smoking per year, most of these occurring at ages 30–69 years, where decades of good life are lost compared to otherwise similar non-smokers<sup>5</sup>. Unlike most countries, the most common type of smoking tobacco product in India are bidis, followed by cigarettes. Over the last decade or so, cigarettes, however, have started displacing bidis, particularly among young adult and poorer men<sup>4</sup>.

In India, the power to levy ‘duties of excise on tobacco’ lies with the central (i.e., federal) government<sup>6</sup>. The central government imposes a number of taxes on tobacco products — duties in the form of central excise on the sale of different tobacco products, a surcharge towards the National Calamity Contingency Fund, and special excise duties. The India central tobacco tax structure is overly complex, even chaotic<sup>7</sup>. The basic excise duty (BED), by far the most important tax imposed on cigarettes, varies by length and whether or not cigarettes are filtered. In June 2018, the specific cigarette tax on the most popular filter cigarettes (> 60 to 70 mm) was approximately 28 Rupees (Rs) per pack of 10 cigarettes, about USD 0.40 or € 0.35. Taxes on bidis, however, are negligible. From the mid-2000s, States and Union Territories began switching away from a system based on numerous sales taxes to one more focused on value-added taxes (VAT)<sup>8</sup>. By 2008, most States and Union Territories had introduced VAT on goods, including bidis and cigarettes. State VAT rates on bidis and cigarettes have varied widely through time, between States, and between the products themselves (bidis and cigarettes). In July 2017, all State VATs were repealed and replaced by a national Goods and Services Tax (GST) that uses four tax rates: bidis and cigarettes are taxed at 28%, the highest rate. Cigarettes that are no more than 75 mm in length face an additional 5% while cigarettes that are greater than 75 mm are taxed an additional 36%<sup>9</sup>.

Increasing tobacco prices has repeatedly been found to be the most effective intervention to curb tobacco use. Moreover, in high-income countries, youth as well as individuals of lower socioeconomic status have been found to be generally more responsive to changes in prices<sup>10–12</sup>. Given the importance of price and tax measures to reduce tobacco use, keeping track of prices and taxes across time and space ought to be an essential component of tobacco control surveillance. It is, however, a component that is too often ignored. Existing studies that examined trends in cigarette prices and affordability have almost exclusively relied

on Economist Intelligence Unit (EIU) city-level price data<sup>13–15</sup>. The EIU data are collected only semi-annually and cover at best a handful of cities. Most recently, the EIU collected data from just four major Indian cities (Bangalore, Chennai, Mumbai, New Delhi), and from only two (Mumbai, New Delhi) in the early 2000s. More recently, a few studies have made use of self-reported data. For example, Kostova *et al.*<sup>16</sup> examined cross-sectional self-reported data from fifteen countries including India. Such an approach had the advantage of allowing the examination of prices paid by household- or individual-level characteristics but provided no temporal information. The Framework Convention on Tobacco Control (FCTC) recognizes the importance of prices and taxes and recommends monitoring (Articles 6 and 20)<sup>17</sup>. Unfortunately, the current reporting of prices is very limited and poorly documented. Additionally, numerous errors in WHO’s FCTC implementation database have been documented<sup>18</sup>. Given that retail price data are collected regularly by government agencies such as national statistics offices, the failure to track and use these data is of concern. Given India’s size and variations across states in smoking rates, income and income distribution, culture, and religion, city-level data fail to capture important spatial variations. Similarly, EIU city-level data are only measured twice yearly which makes it difficult to look at the effects of taxes on prices and subsequently, the effects of taxes and prices on tobacco use.

Recently, there has been calls for economists and public policy practitioners to make better use of data visualization<sup>19,20</sup>. Our objective is to examine, using graphical methods, trends in smoking tobacco taxes and prices in India at national and state-level.

## Methods

India has a number of price indices: consumer price index (CPI) for Industrial Workers, CPI-IW; CPI for Agricultural Labourers and Rural Labourers, CPI-AL/RL; CPI for Urban Non-Manual Employees, CPI- UNME (discontinued in 2011 and replaced by a rural/urban CPI); and, a Wholesale Price Index (WPI). All-India all-items price indices are publicly available through various government online resources. All-India price indices for bidis and cigarettes are available online for some, but not all, indices. The Office of the Economic Adviser, Ministry of Commerce & Industry publishes monthly bidi and cigarette wholesale price indices while the Labour Bureau, Ministry of Labour and Employment publishes bidi and cigarette retail price indices, based on CPI-IW<sup>ii</sup>. Village and centre-level prices are available from the Labour Bureau in paper and electronic format. We compiled a unique set of monthly data, covering three price indices over more than 15 years, which involved the digitization of more than 12 000 pages (most pre-2006 village and centre-level data were available in paper format only). We interpolated missing price data using piecewise cubic Hermite interpolation at village or centre-level<sup>21</sup>.

*Consumer Price Index, Industrial Workers (CPI-IW)*. Compiled and collected by the Labour Bureau of the Ministry of Labour and Employment, the objective of CPI-IW is to measure

<sup>i</sup>Also known as beedis, beeris or biris, bidis are slim, hand-rolled, unfiltered cigarettes rolled in a tendu leaf or temburni leaf and held together by a cotton thread that contain about 1/4 the tobacco of cigarettes. Bidis are available branded and unbranded and are about four to eight cm in length.

<sup>ii</sup>WPI, [caindustry.nic.in](http://caindustry.nic.in); CPI-IW, [labourbureau.gov.in](http://labourbureau.gov.in).

price changes for goods and services consumed by workers in seven industrial sectors (factories, mines, plantations, railways, public motor transport undertakings, electricity generation and distribution establishments, and ports and docks). Prices for about 370 items (including bidis and cigarettes) are collected monthly from about 300 price collection markets across about 80 centres (from most, but not all, states). CPI-IW is used primarily to determine the dearness allowance being paid to Central/State government and industrial sector employees based on revision and fixation of minimum wages. We have obtained CPI-IW retail prices for bidis and cigarettes at centre-level from January 1998 to March 2018 for most, but not all, months and centres. We have also obtained national indices for bidis and cigarettes from January 1998 to April 2018.

*Consumer Price Index, Agricultural Labourers and Rural Labourers (CPI-AL/RL).* Compiled by the Labour Bureau of the Ministry of Labour and Employment and collected monthly by the National Sample Survey Office (NSSO) from about 1500 markets in 600 villages in 20 states, CPI-AL/RL has the objective of measuring price changes for goods and services consumed by agricultural and rural labourers. CPI-AL/RL is used to guide the revision of minimum wages of agricultural and rural workers. We have obtained CPI-AL/RL retail prices for bidis and cigarettes at village-level from January 1998 to April 2014 for most, but not all, months and villages.

*Wholesale Price Index (WPI).* Compiled by the Office of the Economic Adviser, Department of Industrial Policy & Promotion, Ministry of Commerce & Industry, WPI measures weekly price movement, at the level of either the wholesaler or the producer. Prior to the 2011–12 revision, wholesale prices represented ex-factory/ex-mining prices of commodities minus trade discount (if any) plus central excise duty (including cess) and do not take into account retail margins. WPI calculated with 2011–12 base year no longer include taxes. Wholesale prices are collected for more than 600 commodities including bidis and cigarettes. The overall monthly all-India WPI is available online from April 1953; a composite of bidi, cigarettes, tobacco and zarda<sup>iii</sup> is available from 1971; and, disaggregated price indices for bidis and cigarettes are available from April 1982.

*Self-reported unit values.* Self-reported prices allow the examination of prices by smokers' characteristics (e.g., socioeconomic status). Akin to most household surveys, India's National Sample Survey (NSS)<sup>iv</sup> collects, at household level, expenditures and quantity consumed for various items such as food, tobacco, and alcohol products. Self-reported expenditures and unit value (average expenditure per unit) can then be used as a proxy for price. We used data from National Sample Surveys conducted between 1999–00 and 2011–12 (NSS 55–57, 59–64, 66, 68)<sup>v</sup>. We inspected unit values for outliers. First, we charted

box plots and histograms. Second, we removed unit values whose logarithms lied more than 2.5 standard deviations from the mean<sup>22</sup>.

*Affordability.* We explored affordability (i.e., cost in terms of income) using both retail prices and self-reported prices. First, we used quarterly growth rates of real gross domestic products (GDP) from the Quarterly National Accounts (growth rate compared to previous quarter, seasonally adjusted)<sup>vi</sup>. To weigh GDP by population, we used annual population estimates ( $\geq 15$  years old) from the United Nations Population Division<sup>vii</sup>. We converted annual population estimates to quarterly estimates using the proportional Denton method<sup>23</sup>. Second, we used NSS data to construct a measure of affordability at household level that represents the cost of purchasing 100 packs of 10 cigarettes or bundles of 25 bidis as a proportion of total monthly household expenditures.

*Taxation.* We compiled relevant tax rates at both central and state-level from a large number of government (most often tax schedules from finance departments) and media reports.

*Data handling and visualization:* For figures that present state-level CPI data, in addition to average prices, we show for each data point, the minimum and maximum prices (top panel), 95% confidence intervals<sup>viii</sup> (middle panel) and sample sizes (bottom panel). Data points in dark blue represent average prices that did not require any interpolations. Data points in light blue represent average prices that were calculated from prices that were all interpolated. Data points in 'mid-blue' represent average prices that were based on at least one interpolated price. All data analyses and graphics were done using *Stata/MP* 15.1.

## Results

We present graphically trends in current and real (i.e., prices adjusted for overall inflation) prices of bidis and cigarettes. Whenever relevant, we superimposed key tax changes; central total cigarette taxes are presented in [Table 1](#).

First, we present national trends in nominal and real prices and affordability. [Figure 1](#) presents national CPI-IW real price data from January 2000 to April 2018 for bidis, and cigarettes. ([Figure A1](#) (Extended data<sup>24</sup>.) presents the same data in nominal terms). Real cigarette prices increased nearly two-fold between 2000 and 2017 while real bidi prices increased by more than 160%. Put differently, between 2000 and 2017, cigarette and bidi real prices increased at an annual rate of about 3 and 3.7%, respectively. These price increases may appear substantial but do not take into account changes in income over the same period. [Figure 2](#) presents a measure of affordability. The top panel presents nominal indices for bidis and cigarettes and GDP per capita; the bottom panel presents our measure of affordability, CPI tobacco / GDP per capita (a decreasing affordability index indicates that tobacco products have become more

<sup>iii</sup>Zarda is a form of smokeless tobacco made from raw tobacco leaves and flavouring essence such as lime and saffron.

<sup>iv</sup>[mospi.nic.in/sample-surveys](http://mospi.nic.in/sample-surveys)

<sup>v</sup>NSS 58's data dictionary contains errors that prevented us from appropriately reading the data files; and, NSS 65, 67, 69–71 do not have household consumer expenditure components.

<sup>vi</sup>[stats.oecd.org](http://stats.oecd.org)

<sup>vii</sup>[population.un.org/wpp](http://population.un.org/wpp)

<sup>viii</sup>We do not report 95% confidence intervals when the number of observations is less than 5.

**Table 1.** Total central excise duty rates on cigarettes, Rs per 1000 cigarettes (current Rs).

Year	Non-filter		Filter			
	≤ 60 mm	> 60–70 mm	≤ 70 mm	> 70–75 mm	> 75–85 mm	> 85 mm
1993/94	120	250	330	630	850	
1994/95	60	280	370	710	950	1350
1995/96	60	300	400	750	1000	1350
1996/97	75	315	430	800	1070	1350
1997/98	90	350	500	820	1100	1470
1998/99	100	370	550	900	1200	1470
1999/00	110	370	550	945	1200	1545
2000/01	115	390	580	1090	1260	1780
2001/02	135	450	670	1090	1450	1780
2002/03	135	450	670	1090	1450	1780
2003/04	135	450	670	1090	1450	1780
2004/05	135	450	670	1090	1450	1780
2005/06	150	495	740	1200	1595	1960
2006/07	160	520	780	1260	1675	2060
2007/08	168	546	819	1323	1759	2163
2008/09	819	1323	819	1323	1759	2163
2009/10	819	1323	819	1323	1759	2163
	...	...	≤60 mm	> 60–70 mm	...	...
2010/11	669	1473	669	969	1473	2363
2011/12	669	1473	669	969	1473	2363
	≤ 65 mm	> 65–70 mm	≤65 mm	> 65–70 mm	...	...
2012/13	669	1473	669	969	1473	2363
2013/14	669	2027	669	1409	2027	3290
2014/15	1150	2250	1150	1650	2250	3290
2015/16	1440	2590	1440	1900	2590	3790
2016/17	1585	2850	1585	2090	2850	4170
2017*	1681	3021	1681	2216	3021	4421
2017/18**	2166	3813	2166	2837	3813	4405

Note. \* = March–July 2017; \*\* = From 18 July 2017; An additional tax of 5% is applied to all cigarettes < 75 mm; and 36% for cigarettes ≥ 75 mm.

affordable). [Figure 2](#) shows clearly that income growth has outpaced the increases in bidi and cigarette prices. By early 2018, bidis and cigarettes were about 30 and 20% more affordable than they were in early 2000, respectively. [Figure A2–Figure A3](#) (Extended data<sup>24</sup>) present similar trends based on CPI-AL/RL while [Figure A4–Figure A5](#) present WPI data. The diverging trends in later years between WPI and CPI-IW are due to the change in WPI methodology (WPI calculated with 2011-12 base year no longer include taxes).

A closer look at tax policy changes highlighted in [Figure 1](#) clearly indicates that some policy changes affected average prices, and some did not. For example, in March 2010, although

real tax rates decreased for most cigarette categories, taxes on the most popular cigarettes (> 60 to 70 mm) increased by 18% (4.4% after adjusting for inflation). The effect on cigarette prices seems evident. Relatively large tax increases in 2013 and 2014 also seem to have pushed cigarette prices upward. Subsequent tax changes in 2015, 2016, and 2017 seemed to have had no effect on cigarette prices, until the tax overhaul in July 2017. By year end, bidi and cigarette prices had increased by 6.5 and 5.8% in excess of overall inflation.

Second, we present state-level CPI prices. [Figure 3ab](#) and [Figure 4ab](#) show the evolution of bidi and cigarette prices and state-level smoking tobacco taxation in Rajasthan and Uttar

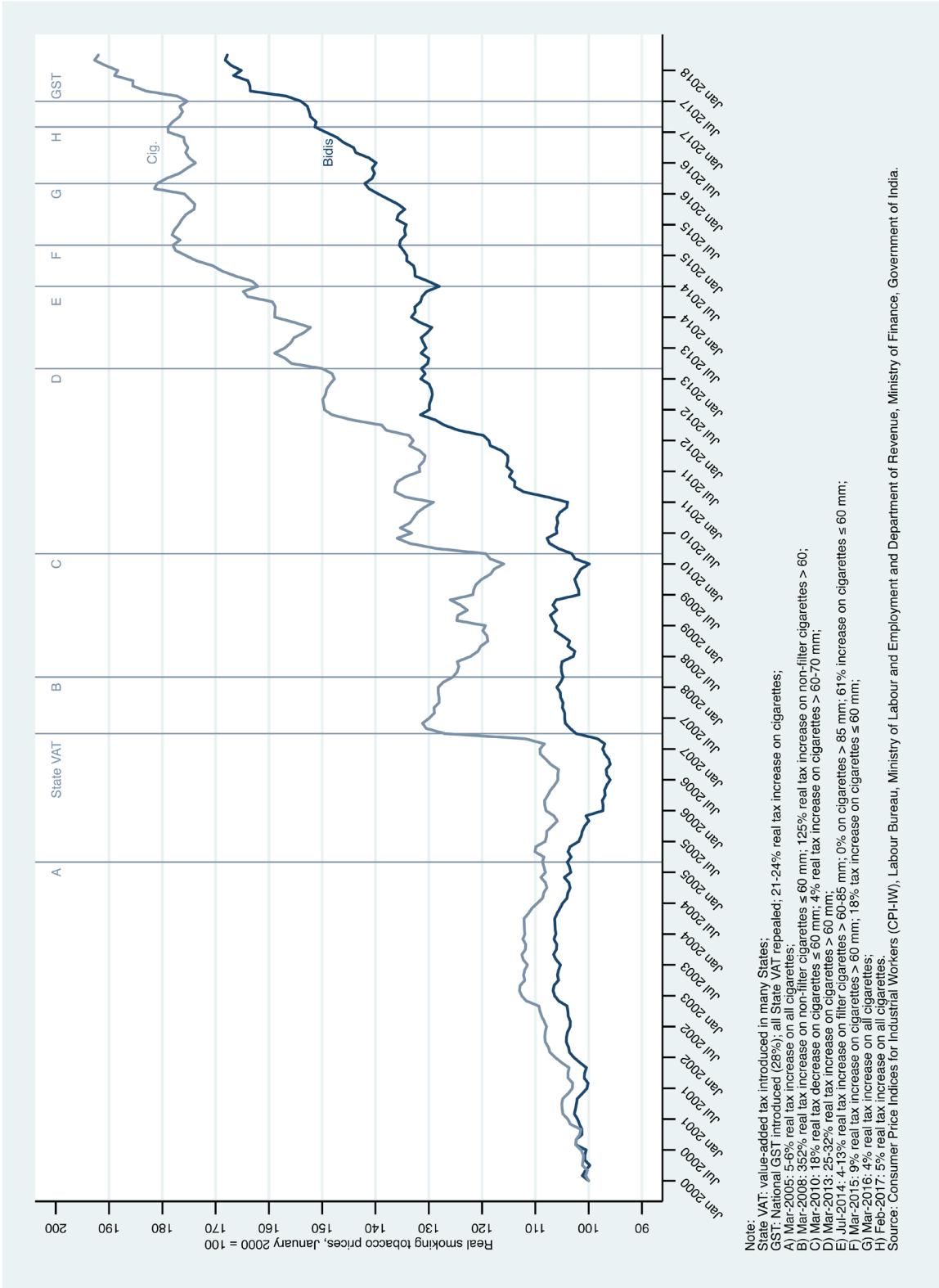
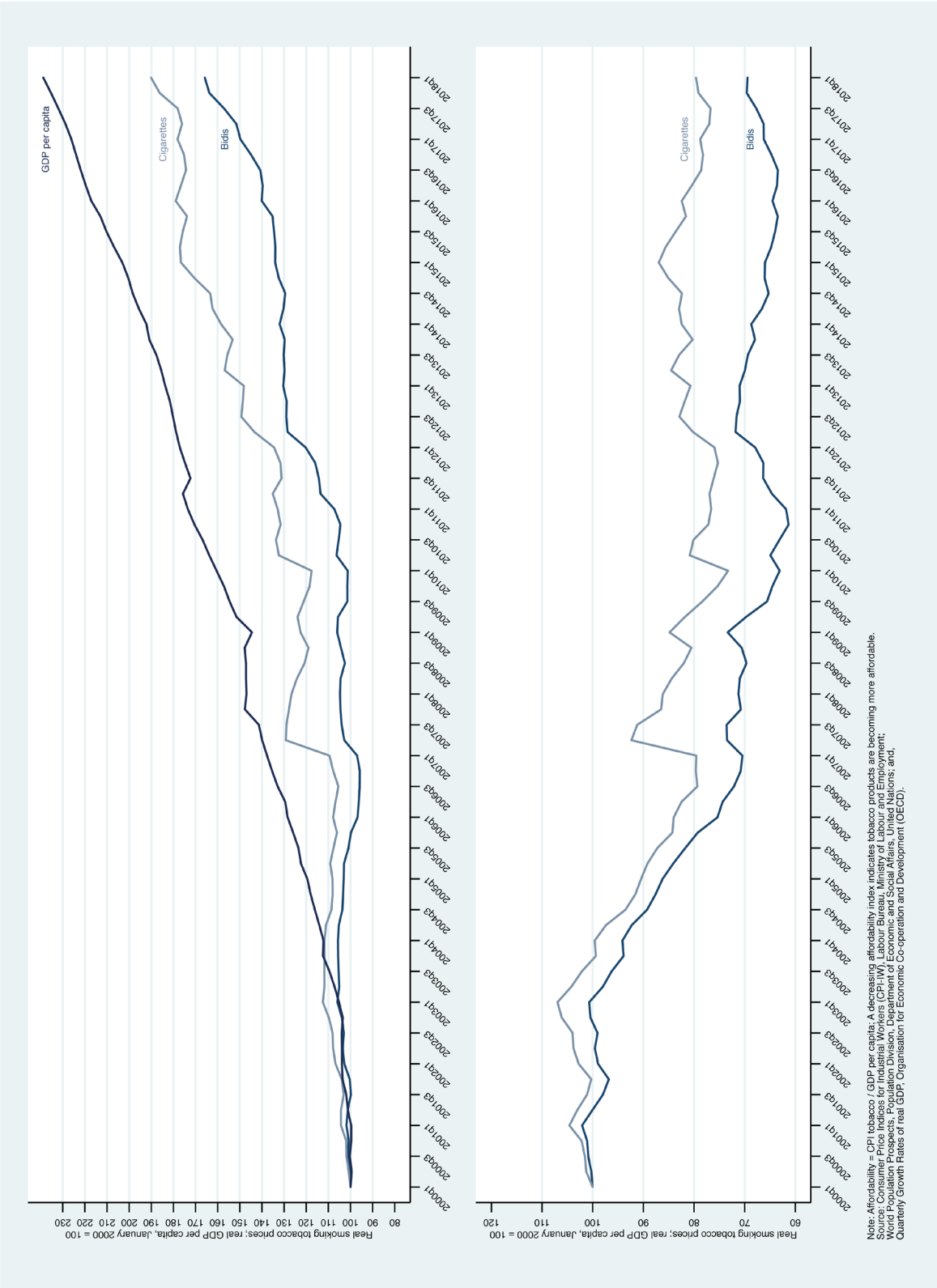


Figure 1. Trends in real prices in India: Consumer Price Indices for bidis, cigarettes and all-items, January 2000 - April 2018.





**Figure 2.** Trends in affordability in India: Consumer Price Indices for Industrial Workers for bidis and cigarettes, Quarterly Growth Rates of real GDP, January-March 2000 — January-March 2018.

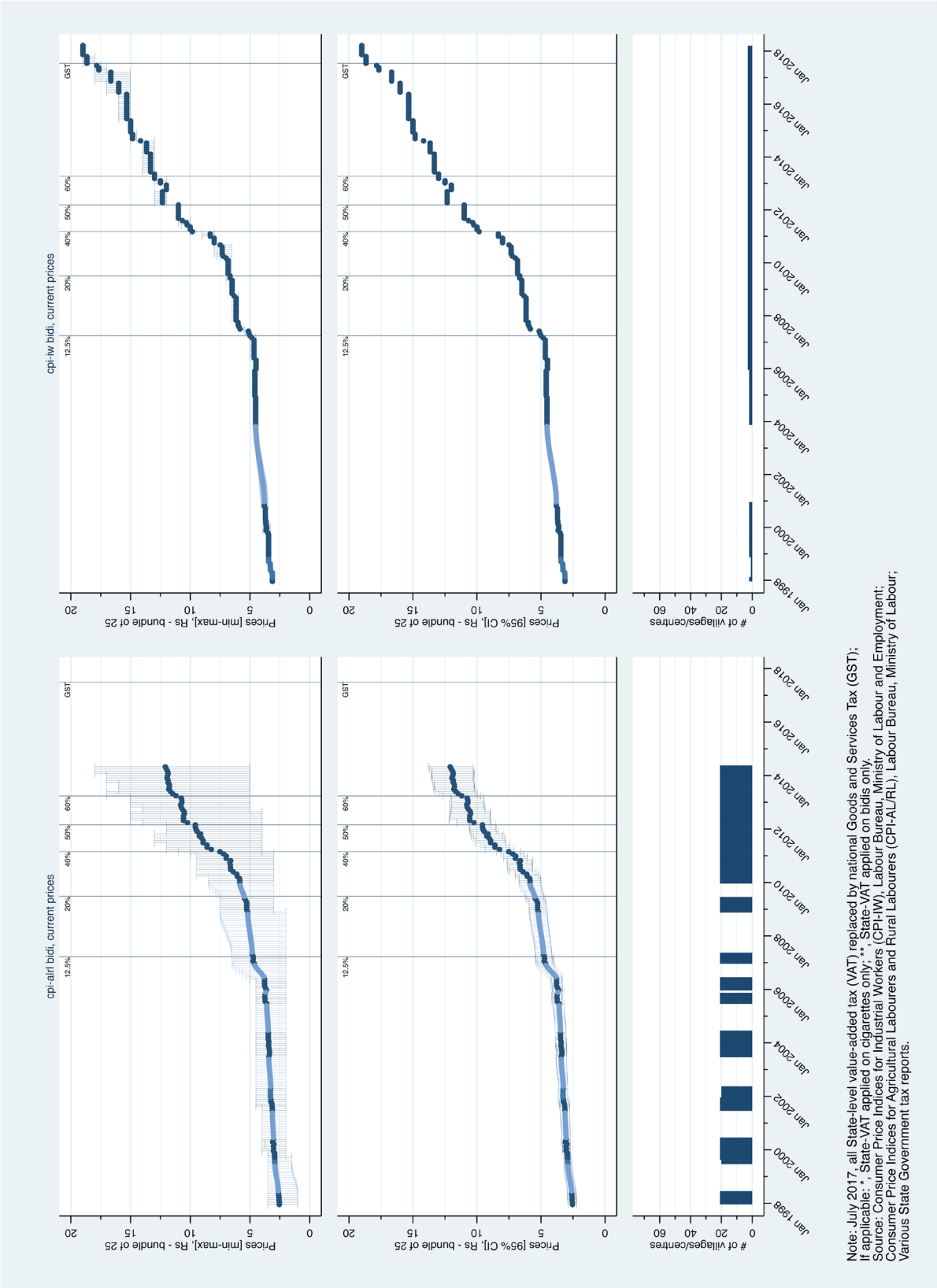


Figure 3a. Trends in current bidi prices and smoking tobacco taxation in Rajasthan, January 1998 - March 2018.



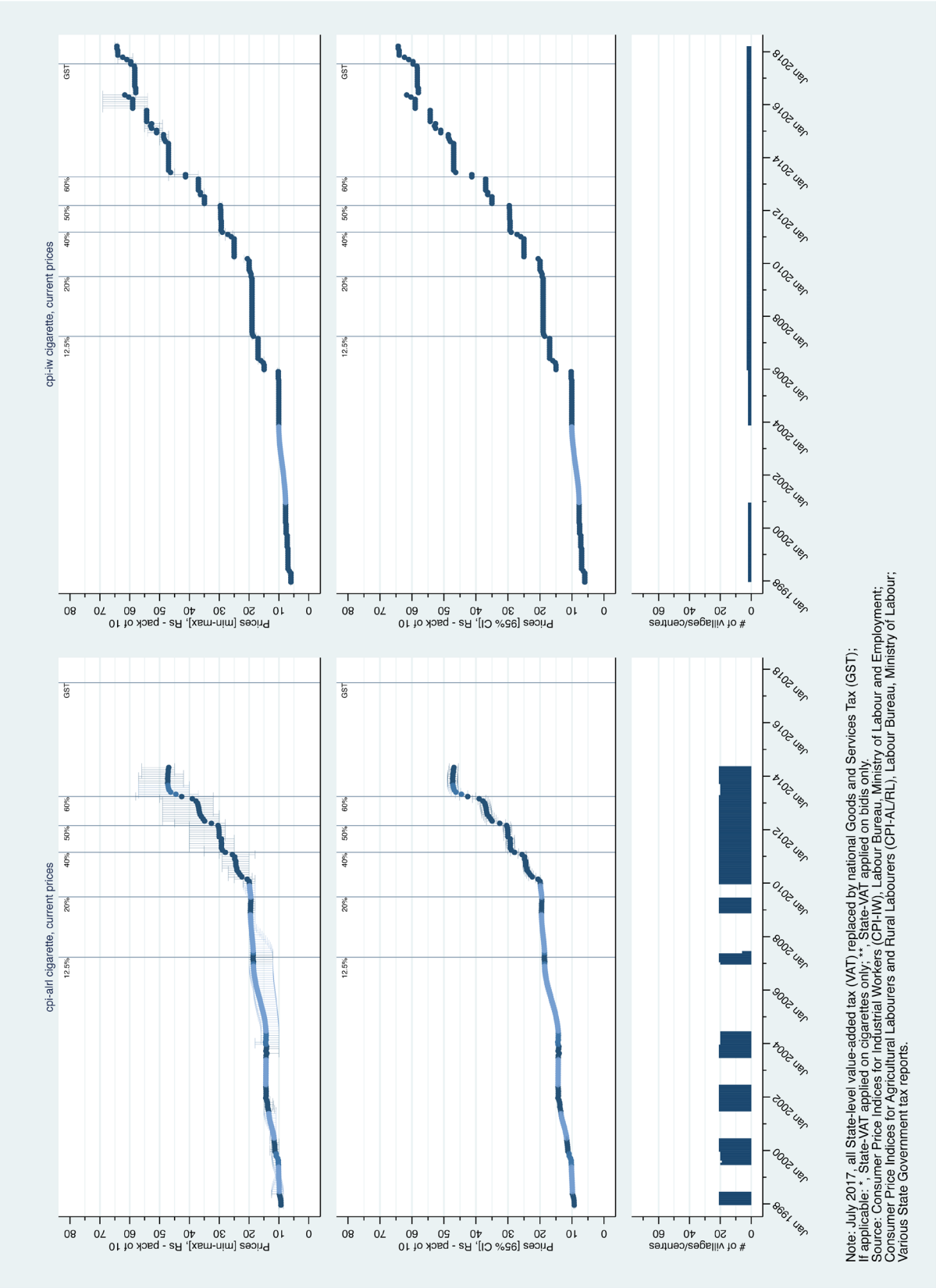


Figure 3b. Trends in current cigarette prices and smoking tobacco taxation in Rajasthan, January 1998 - March 2018.

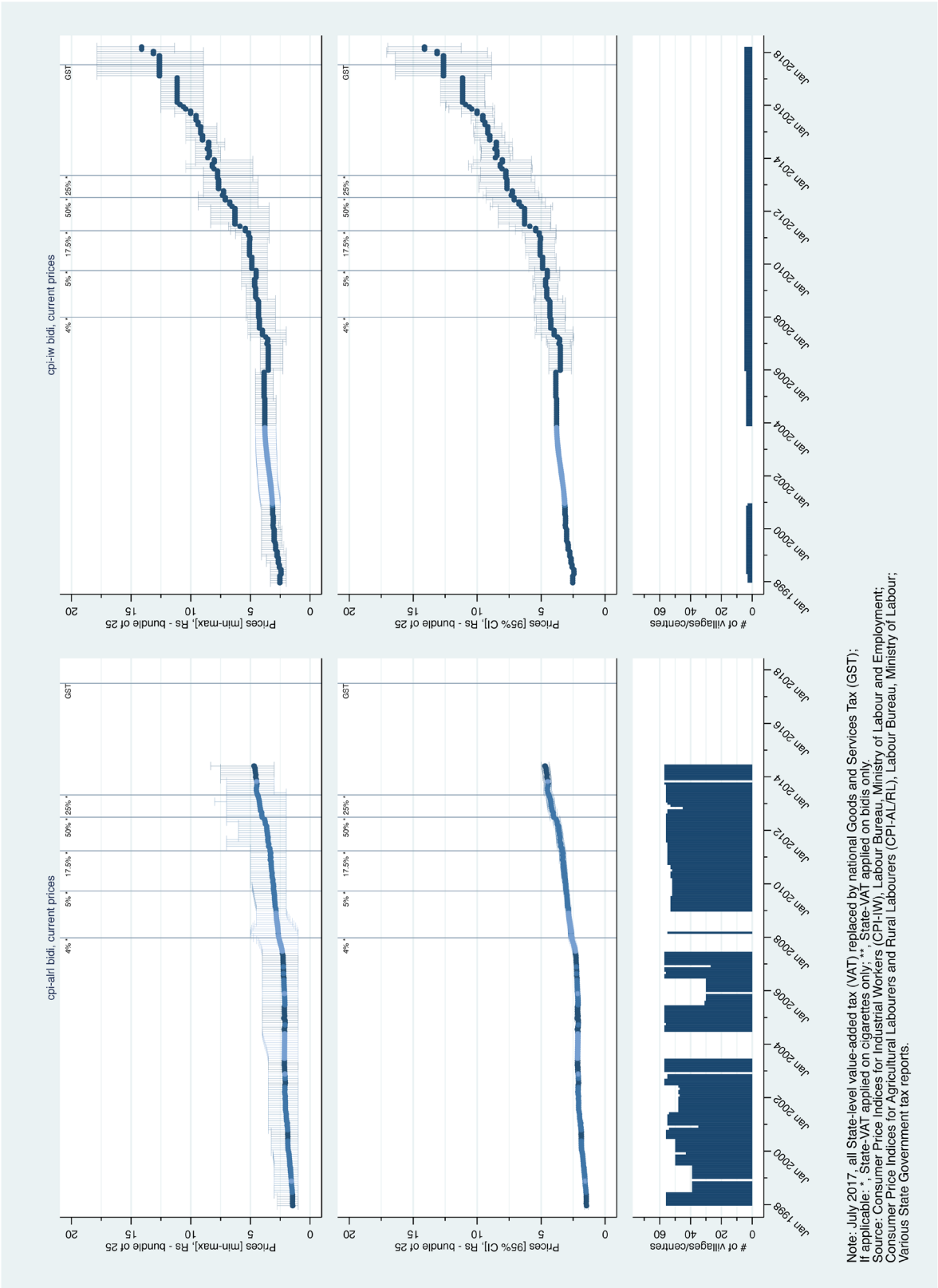


Figure 4a. Trends in current bidi prices and smoking tobacco taxation in Uttar Pradesh, January 1998 - March 2018.

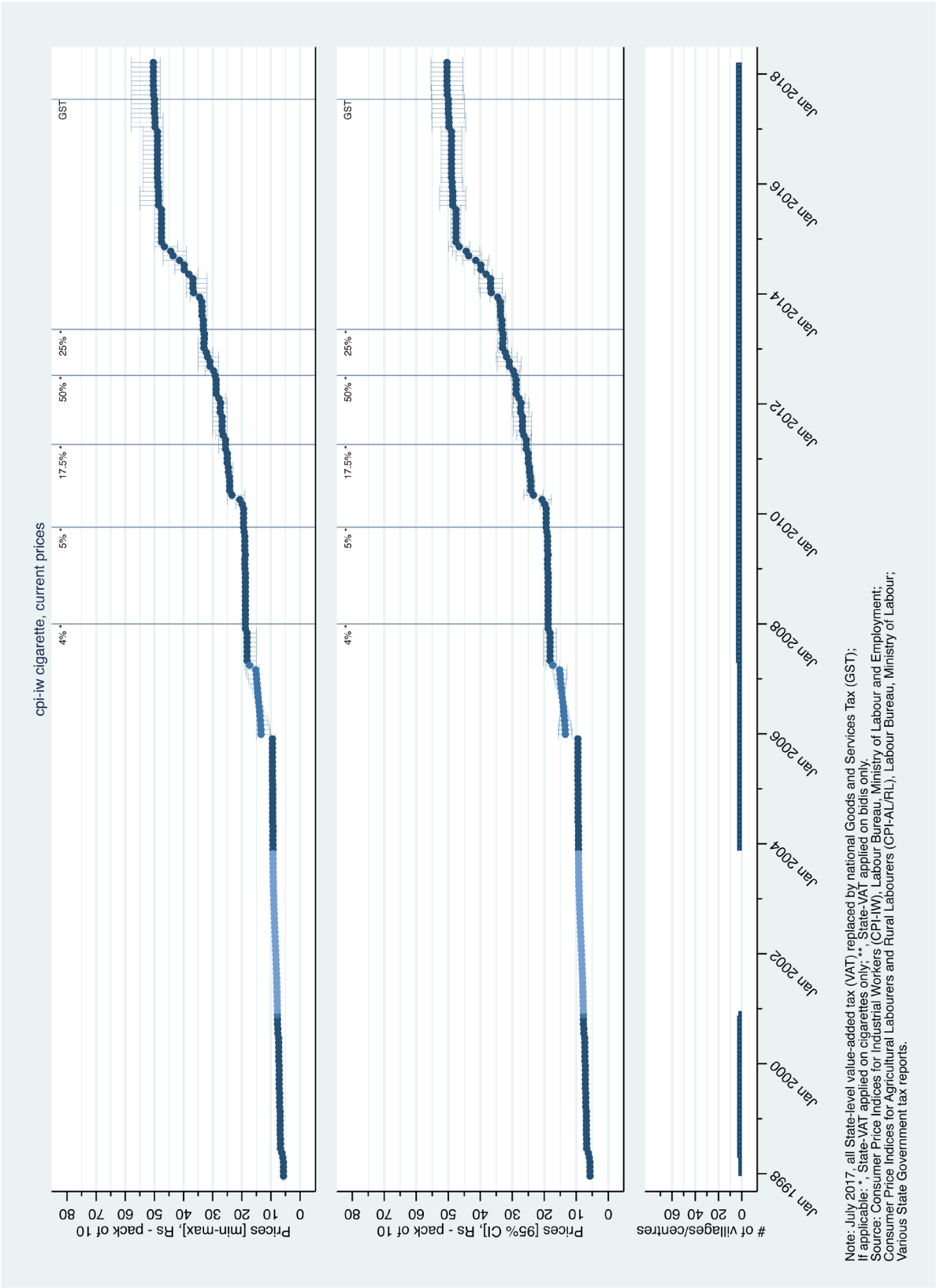


Figure 4b. Trends in current cigarette prices and smoking tobacco taxation in Uttar Pradesh, January 1998 - March 2018.

Pradesh, between January 1998 and March 2018. From 2007, Rajasthan aggressively increased its VAT on bidis and cigarettes. Bidis and cigarettes were first taxed at a rate of 12.5% in April 2007. By April 2013, the rate had been subsequently increased to 20, 40, 50, and 60%. Over the same period, bidi prices (per bundle of 25) increased from less than 5 Rs to between 12 and 14 Rs (Figure 3a). Similarly, cigarette prices increased from less than 20 Rs (per pack of 10) to more than 45 Rs (Figure 3b). In contrast to Rajasthan, Uttar Pradesh did not apply its VAT to bidis. VAT was first applied on cigarettes in January 2008 at a rate of 4%. By 2012, the VAT rate on cigarettes had reached 50% but in May 2013, the rate was reduced in half to 25% (in contrast to Rajasthan that continued to increase its VAT rate). Uttar Pradesh then reversed course in 2015 with an increase to 40%. Bidi prices increased from about 2 Rs per bundle in 2000 to between 3 and 8 Rs in 2014 (Figure 4a). Comparing CPI-IW and CPI-AL/RL data suggests that bidi prices may have been substantially lower in rural areas than in urban areas in Uttar Pradesh. Nominal cigarette prices increased steadily between 2006 from just under 15 Rs to just over 35 Rs per pack (Figure 4b). Of note is the continuing trend after the 50% decrease in VAT which suggest that manufacturers simply increased their profit margins at the expense of government tax revenue. Figure A6–Figure A8 (Extended data<sup>24</sup>) present similar data for Andhra Pradesh, Kerala, and Maharashtra.

Third, we present prices paid by household of differing SES-levels and between rural and urban households based on NSS unit values. Figure 5a and Figure 5b present trends in current bidi and cigarette prices (top panel) and affordability (middle panel) by household total expenditures tertiles (in the top and middle panels, data points in dark, 'mid', and light blue represent self-reported prices paid by low-, mid-, and high-SES household, based on household total expenditure, respectively; the bottom panel reports the total number of households that reported both quantity purchased and expenditure). As expected, low-SES households reported paying lower prices than high-SES households. Of note is the increasing gap between high- and low-SES households in self-reported bidi prices. In the early 2000s, differences were negligible. In the early 2010s, low-SES household reported paying nearly 2 Rs less per bundle of 25 bidis. In contrast, the gap between high- and low-SES households in self-reported cigarette prices remained more or less the same between 2000 and 2012. In contrast to rising current prices, the affordability of bidis and cigarettes remained relatively constant. Figure A9a and b (Extended data<sup>24</sup>) present the data by rural/urban status. There were small differences in self-reported unit values for bidis between rural and urban households while urban households reported slightly higher unit values for cigarettes, with no discernible change through time.

## Discussion

**Main findings.** We presented data that clearly show that average nominal prices of bidis and cigarettes in India have increased (at a relatively increasing rate) since January 2000. In real terms (i.e., after adjusting for overall inflation), prices of bidis and cigarettes were relatively flat (even decreasing in the case of bidis) between 2000 and 2007 and clearly increasing from

2010. The aforementioned trends, however, do not take into account increasing income, which increased on average by almost 6% per year. When rising income is taken into account, both cigarettes and bidis have not become less affordable between 2000 and 2018. We also found that some, but not all, tax changes were accompanied by price changes. The extent to which tobacco manufacturers adjusted prices following tax changes varied in time as well as by states and products.

**Strengths.** We used two approaches to examine bidi and cigarette prices at national and state level. First, we used retail prices collected by the Labour Bureau. Second, we used unit values reported by households in 11 waves of the National Sample Survey. This approach provided both ample time and spatial variations. We dealt with missing values by first carefully examining and removing outliers and second, by interpolating missing values using piecewise cubic Hermite interpolation at the lowest level (i.e., village and centre-level). We constructed a dataset of bidi and cigarette prices and tax policies at national and state-level from 1998. The data we present came from an array of data sources and varied both in time and space which makes it difficult to present in tabular format. We show that graphical methods can be used to present data more effectively. For example, in some of our figures, we presented secular trends in monthly average prices, along with minimum and maximum prices, 95% confidence intervals, and sample sizes. We then superimposed key tax changes and indicated which monthly data point had been interpolated.

**Limitations.** For some of the state-level trends based on CPI-IW and CPI-AR/RL data, there were obvious breaks in the price series in January 2006 due, in part, to the addition of new markets being sampled or a change in the products sampled. Consequently, any changes that occurred between December 2005 and January 2006 should be treated with caution. Although price and unit value data are available for smokeless tobacco, the product diversity makes it hard to make sense of the data. For example, price and unit value data were, most often than not, bimodal.

**Implications for policy, practices and research.** Although bidi and cigarette real prices have increased substantially between 2000 and 2018, bidis and cigarettes were nevertheless about 40 and 20% more affordable than they were in early 2000, respectively. Given that the International Monetary Fund (IMF) projects India's GDP per capita to grow by about 9 to 11% annually, over the next five years, large and sustained tax increases will be required to prevent bidis and cigarettes from becoming yet more affordable<sup>25</sup>. The data presented show that some but not all tax changes were accompanied by price changes. Of importance is the observation that tax *decreases* did not result in *price* decreases. This is unsurprising as cigarette manufacturers typically protest any tax increases (even benign ones) and often fully pass-through or even overshift tax increases<sup>26–29</sup>.

The main implication for policy is the need for much larger tax increases that are implemented quickly, and are far above the rate of income growth. Large increases in excise taxation

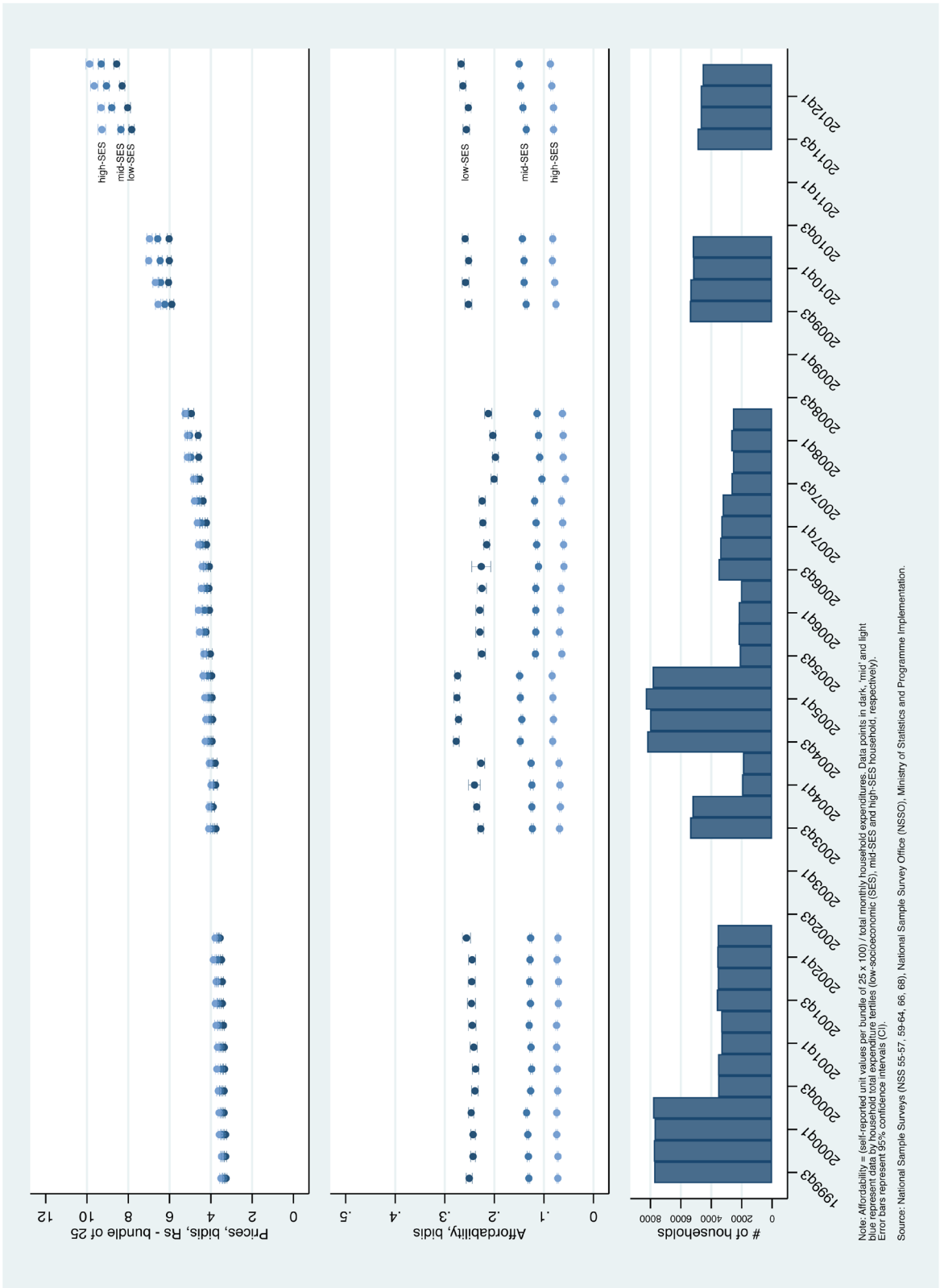


Figure 5a. Trends in current bidi prices and affordability by socioeconomic status in India: National Sample Surveys, July-September 1999 — April-June 2012.

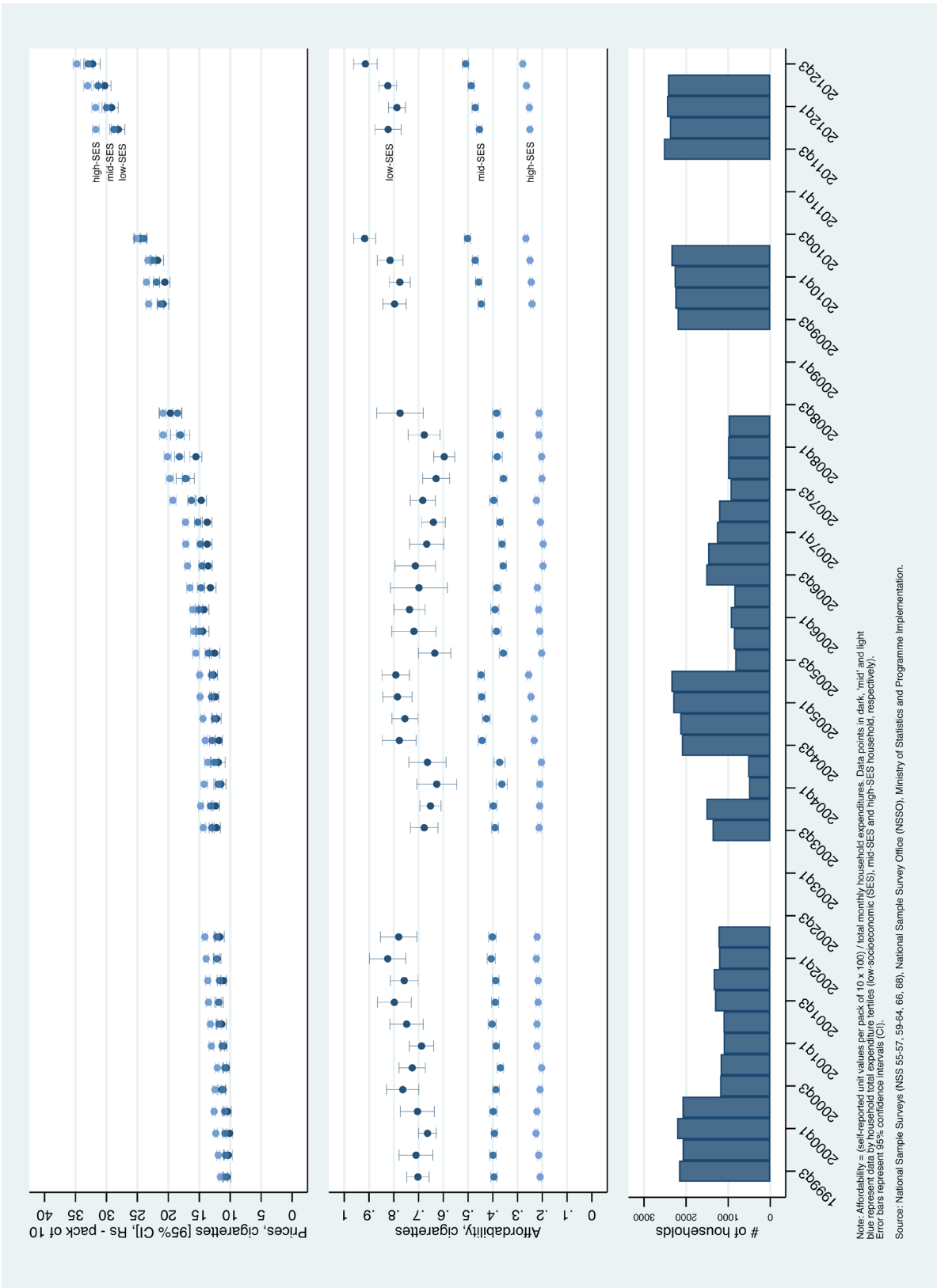


Figure 5b. Trends in current cigarette prices and affordability by socioeconomic status in India: National Sample Surveys, July-September 1999 — April- June 2012.



have the benefit of also signaling to smokers that future price increases are likely. Moreover, use of excise taxation to narrow the gap between the least and most expensive lengths is needed to decrease downward substitution, as well as to capture a greater proportion of the revenue<sup>30,31</sup>. Indeed, the relatively small increases in excise taxation in India have created opportunities for the tobacco industry to raise their profits.

The dataset we have compiled demonstrate the feasibility of documenting prices and taxes at national, state, and district-level by making use of routinely collected data to evaluate current tax and price policies. Such data can and should be routinely compiled and examined by tobacco control practitioners in India and elsewhere, as nearly all countries collect monthly price data to construct price indices such as consumer price indices. Moreover, these price data can be linked with existing surveys such as the National Sample Surveys and improve the assessment of the impact of price changes on tobacco use<sup>32–36</sup>.

In sum, we establish the feasibility of using routinely collected tax and price data from national consumer price surveys to evaluate tobacco control policies. The CPIs are collected widely and offer a low-cost, generally publicly available dataset to track tobacco taxation. In India, these routine data reveal that the sub-optimal use of large increases in excise taxes are not changing affordability of cigarettes in particular<sup>7</sup>.

## Data availability

The data required to construct all figures that present price indices are publicly available from various Indian government sources and the OECD (Figure 1–Figure 4, Figure A1–Figure A8).

We have deposited the data that were used to create these figures along with our Stata codes in an online repository - Open Science Framework:

OSF: Dataset 1. Visualizing data: Trends in smoking tobacco prices and taxes in India <https://doi.org/10.17605/OSF.IO/UJXD6><sup>24</sup>

License: [CC0 1.0 Universal](#)

- Figures 1, A1-A5: all\_india\_m.csv; graphics\_all-india\_vDec2018\_1.do
- Figure 2: all\_india\_q.csv; graphics\_all-india\_vDec2018\_1.do
- Figures 3-4, A6-A8: cpi\_iw\_Dec2018\_1.csv; cpi\_al-rl\_vDec2018\_1.csv; cpi\_iw\_centre\_codes.dta; cpi\_al-rl\_village\_codes.dta; graphics\_vDec2018\_1-iw\_alrl.do

The data required to create Figures 5 and A9 are not publicly available but can be obtained from the the Ministry of Statistics and Programme Implementation, Government of India for a fee (see <http://mospi.nic.in/sample-surveys> for more details).

- Figures 5, A9: graphics\_vDec2018\_1-nss\_uv.do; graphics\_vDec2018\_1-nss\_aff.do

## Extended data

The following supplementary figures are available from OSF

OSF: Extended data. Visualizing data: Trends in smoking tobacco prices and taxes in India <https://doi.org/10.17605/OSF.IO/UJXD6><sup>24</sup>

License: [CC0 1.0 Universal](#)

- Figure A1. Trends in current and real prices in India: Consumer Price Indices for Industrial Workers for bidis, cigarettes and all-items, January 2000 - April 2018.
- Figure A2. Trends in current prices in India: Consumer Price Indices for Agricultural Labourers and Rural Labourers for bidis, cigarettes and all-items, January 2000 - April 2014.
- Figure A3. Trends in real prices in India: Consumer Price Indices for Agricultural Labourers and Rural Labourers for bidis and cigarettes, January 2000 - April 2014.
- Figure A4. Trends in current prices in India: Wholesale Price Indices for bidis, cigarettes and all-items, January 2000 — April 2018.
- Figure A5. Trends in real prices in India: Wholesale Price Indices for bidis and cigarettes, January 2000 — May 2018.
- Figure A6a. Trends in current bidi prices and smoking tobacco taxation in Andhra Pradesh, January 1998 - March 2018.
- Figure A6b. Trends in current cigarette prices and smoking tobacco taxation in Andhra Pradesh, January 1998 - March 2018.
- Figure A7a. Trends in current bidi prices and smoking tobacco taxation in Kerala, January 1998 - March 2018.
- Figure A7b. Trends in current cigarette prices and smoking tobacco taxation in Kerala, January 1998 - March 2018.
- Figure A8a. Trends in current bidi prices and smoking tobacco taxation in Maharashtra, January 1998 - March 2018.
- Figure A8b. Trends in current cigarette prices and smoking tobacco taxation in Maharashtra, January 1998 - March 2018.
- Figure A9a. Trends in current bidi prices by rural/urban status in India: National Sample Surveys, July-September 1999 — April-June 2012.
- Figure A9b. Trends in current cigarette prices by rural/urban status in India: National Sample Surveys, July-September 1999 — April-June 2012.

## Grant information

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(MOHLTC) Chair in Health Equity, an endowed Chair funded in part by the MOHLTC.

*The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

## Acknowledgements

We thank Cuiping Long, Jonathan Garipey, Danielle Martin, and Sandya Menon for their research assistance, Prabha Sati for facilitating data collection and Yaswanta Gummadi and Sophiya Garasia for their comments and discussion.

## References

- GBD 2015 Risk Factors Collaborators: **Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015**. *Lancet*. 2016; 388(10053): 1659–724. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- GBD 2015 Tobacco Collaborators: **Smoking prevalence and attributable disease burden in 195 countries and territories, 1990-2015: a systematic analysis from the Global Burden of Disease Study 2015**. *Lancet*. 2017; 389(10082): 1885–906. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Lim SS, Vos T, Flaxman AD, *et al.*: **A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010**. *Lancet*. 2012; 380(9859): 2224–60. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Mishra S, Joseph RA, Gupta PC, *et al.*: **Trends in bidi and cigarette smoking in India from 1998 to 2015, by age, gender and education**. *BMJ Glob Health*. 2016; 1(1): e000005. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Jha P, Jacob B, Gajalakshmi V, *et al.*: **A nationally representative case-control study of smoking and death in India**. *N Engl J Med*. 2008; 358(11): 1137–47. [PubMed Abstract](#) | [Publisher Full Text](#)
- Crossen S: **Preparing the way for a modern GST in India**. *Int Tax Public Finan*. 2013; 20(4): 715–23. [Publisher Full Text](#)
- Jha P, Guindon E, Joseph RA, *et al.*: **A rational taxation system of bidis and cigarettes to reduce smoking deaths in India**. *Econ Polit Wkly*. 2011; XLVI(42): 44–51. [Reference Source](#)
- Thirteenth Finance Commission: **Report of the Task Force on Goods & Services Tax**. Delhi: Government of India. 2009. [Reference Source](#)
- Ministry of Finance: **Increase in the Compensation Cess rate on cigarettes to make the total tax incidence on cigarettes in GST regime at par with the total tax incidence in pre-GST regime**. Delhi: Government of India. 2017. [Reference Source](#)
- Chaloupka FJ, Warner KE: **The Economics of Smoking**. In: Culyer AJ, Newhouse JP, eds. *Handbook of Health Economics*. Amsterdam: Elsevier Science, North-Holland; 2000; 1, Part B: 1539–627. [Publisher Full Text](#)
- International Agency for Research on Cancer: **IARC Handbooks of Cancer Prevention: Tobacco Control**. Volume 14. *Effectiveness of Price and Tax Policies for Control of Tobacco*. Lyon: International Agency for Research on Cancer. 2011. [Reference Source](#)
- U.S. National Cancer Institute, World Health Organization: **The Economics of Tobacco and Tobacco Control**. National Cancer Institute Tobacco Control Monograph 21. NIH Publication No. 16-CA-8029A. Bethesda MD; Geneva CH: National Institutes of Health, National Cancer Institute; and World Health Organization. 2016. [Reference Source](#)
- Guindon GE, Tobin S, Yach D: **Trends and affordability of cigarette prices: ample room for tax increases and related health gains**. *Tob Control*. 2002; 11(1): 35–43. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Blecher EH, van Walbeek CP: **An international analysis of cigarette affordability**. *Tob Control*. 2004; 13(4): 339–46. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Blecher EH, van Walbeek CP: **Cigarette affordability trends: an update and some methodological comments**. *Tob Control*. 2009; 18(3): 167–75. [PubMed Abstract](#) | [Publisher Full Text](#)
- Kostova D, Chaloupka FJ, Yurekli A, *et al.*: **A cross-country study of cigarette prices and affordability: evidence from the Global Adult Tobacco Survey**. *Tob Control*. 2014; 23(1): e3. [PubMed Abstract](#) | [Publisher Full Text](#)
- World Health Organization: **Framework Convention on Tobacco Control**. Geneva: World Health Organization. 2003. [Reference Source](#)
- Hoffman SJ, Rizvi Z: **WHO's undermining tobacco control**. *Lancet*. 2012; 380(9843): 727–8. [PubMed Abstract](#) | [Publisher Full Text](#)
- Schwabish JA: **An Economist's Guide to Visualizing Data**. *J Econ Perspect*. 2014; 28(1): 209–34. [Publisher Full Text](#)
- Otten JJ, Cheng K, Drewnowski A: **Infographics And Public Policy: Using Data Visualization To Convey Complex Information**. *Health Aff (Millwood)*. 2015; 34(11): 1901–7. [PubMed Abstract](#) | [Publisher Full Text](#)
- Cox NJ: **PCHIPOLATE: Stata module for piecewise cubic Hermite interpolation**. S457561 ed: Boston College Department of Economics; 2012. [Reference Source](#)
- Deaton A, Tarozzi A: **Prices and Poverty in India**. In: Deaton A, Kosel V, eds. *The Great India Poverty Debate*. Delhi: MacMillan; 2005; 381–411.
- Baum C, Hristakeva S: **DENTON: Stata module to interpolate a flow or stock series from low-frequency totals via proportional Denton method**. 2014. [Reference Source](#)
- Guindon GE, Fatima T: **Visualizing Data: Trends in Smoking Tobacco Prices and Taxes in India**. OSF Web. 2018.
- International Monetary Fund: **World Economic Outlook Database**. April 2018 Edition. Washington, DC: International Monetary Fund; 2018. [Reference Source](#)
- Harris JE: **The 1983 Increase in the Federal Cigarette Excise Tax**. In: Summers LH, ed. *Tax policy and the economy*. Cambridge, MA: NBER and MIT Press Journals; 1987. [Reference Source](#)
- Keeler TE, Hu TW, Barnett PG, *et al.*: **Do cigarette producers price-discriminate by state? An empirical analysis of local cigarette pricing and taxation**. *J Health Econ*. 1996; 15(4): 499–512. [PubMed Abstract](#) | [Publisher Full Text](#)
- Chaloupka FJ, Cummings KM, Morley CP, *et al.*: **Tax, price and cigarette smoking: evidence from the tobacco documents and implications for tobacco company marketing strategies**. *Tob Control*. 2002; 11 Suppl 1: 162–72. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Kostova D, Andes L, Erguder T, *et al.*: **Cigarette prices and smoking prevalence after a tobacco tax increase—Turkey, 2008 and 2012**. *MMWR Morb Mortal Wkly Rep*. 2014; 63(21): 457–61. [PubMed Abstract](#) | [Free Full Text](#)
- Jha P, MacLennan M, Chaloupka FJ, *et al.*: **Chapter 10. Global Hazards of Tobacco and the Benefits of Smoking Cessation and Tobacco Taxes**. In: Gelband H, Jha P, Sankaranarayanan R, Horton S, eds. *Cancer Disease Control Priorities*, third edition, volume 3. Washington, DC: World Bank; 2015. [Reference Source](#)
- Marquez PV, Moreno-Dodson B: **Tobacco Tax Reform at the Crossroads of Health and Development. A Multisectoral Perspective**. Washington, DC: World

Bank; 2017.

[Reference Source](#)

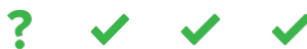
32. Gibson J, Rozelle S: **Prices and unit values in poverty measurement and tax reform analysis.** *World Bank Econ Rev.* 2005; **19**(1): 69–97.  
[Publisher Full Text](#)
33. John RM: **Price elasticity estimates for tobacco products in India.** *Health Policy Plan.* 2008; **23**(3): 200–9.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
34. Guindon GE, Nandi A, Chaloupka FJ: **Socioeconomic Differences in the Impact**

**of Smoking Tobacco and Alcohol Prices on Smoking in India.** NBER Working Paper No. 17580. Cambridge, MA: National Bureau of Economic Research. 2011.  
[Reference Source](#)

35. McKelvey C: **Price, unit value, and quality demanded.** *J Dev Econ.* 2011; **95**(2): 157–69.  
[Publisher Full Text](#)
36. Selvaraj S, Srivastava S, Karan A: **Price elasticity of tobacco products among economic classes in India, 2011-2012.** *BMJ Open.* 2015; **5**(12): e008180.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

# Open Peer Review

Current Peer Review Status:



Version 1

Reviewer Report 06 March 2019

<https://doi.org/10.21956/gatesopenres.13990.r26874>

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**Pranay Lal**

International Union Against Tuberculosis and Lung Disease (The Union), New Delhi, India

The objective of the study can be put simply as: “We study the feasibility of using routinely collected price data from national consumer price surveys (like CPI) to estimate affordability and calibrate optimal tobacco taxes for tobacco products in India.”

In terms of methodology, since CPI (Rural/ Urban) is available for a small sample of NSS 2011, it may be useful to estimate the inflation trends in rural/ urban settings in states.

The authors can also elaborate that each index has its strengths and weaknesses, and the selected measure of inflation should broadly capture the interplay of effective demand and supply in the national and state economy at various times. The authors may elaborate that old base periods – for WPI (1993–94), CPI-UNME (1984–85), CPI-RL (1986–87), CPI-AL (1986–87) and CPI-IW (2001) – confound estimating the inflation and real price and also fail to capture the volatility of economy of states; and therefore for the purpose of estimation on CPI-IW is valid. It may also be useful for the authors to state the advantages of CPI-IW (also elaborated in Patnaik *et al.*, 2011<sup>1</sup>).

## References

1. Patnaik I, Shah A, Veronese G: How to measure inflation in India?. *NIPFP Working Papers*. 2011; **2011** (83). [Reference Source](#)

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** tobacco control policy and economics, tobacco industry behaviour

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Reviewer Report 06 February 2019

<https://doi.org/10.21956/gatesopenres.13990.r26876>

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**Laura Rossouw**

University of Cape Town, Cape Town, South Africa

The article provides a visual summary of tobacco tax and price trends in India over two decades. More specifically, it evaluates these trends within the broader framework of movements in income, thereby assessing the impact on the affordability of tobacco. The research question is addressed using (predominantly) publicly available, routinely collected data sources. The article is technically rigorous: the data analysis is robust, the conclusions well-summarised, and the article is thorough and well-written.

My only major comment on the article is that, while it is technically sound, the findings could be strengthened by restructuring the research objective. While a descriptive analysis of tobacco price and tax trends in a specific country is interesting, the article plays a more important role in (1) illustrating the usefulness of using routinely collected government data and (2) acting as a rationale for open data access and perhaps even data storage houses. This is not completely clear in the article's current introduction, which jumps around conceptually. The real objective of the paper is better summarised in the final paragraph of the conclusion, namely:

"In sum, we establish the feasibility of using routinely collected tax and price data from national consumer price surveys to evaluate tobacco control policies. The CPIs are collected widely and offer a low-cost, generally publicly available dataset to track tobacco taxation. In India, these routine data reveal that the sub-optimal use of large increases in excise taxes are not changing affordability of cigarettes in particular."

Addressing the research question within this broader framework of using existing data to address tax-related policy questions, and promoting public access to government data sources, the authors could

consider addressing other relevant questions. What are the challenges and opportunities for making government data more freely available – what is the feasibility of this in LMICs? While open-access government data promotes transparency and accountability, are there risks of misuse? What about inaccurate data – is there any way of checking this data quality? How can we determine that government data is correct? What are the risks associated with open access government data? Are there questions of ethics and responsibility when re-using government data? If government data is used more liberally for different purposes, will data quality issues result in the slower release of government data?

There are also some smaller points for the authors to consider:

- Page 3: “Recently, there has been calls for economists and public policy practitioners to make better use of data visualization” – up until this point, the rationale for the article has focused on data collection – data vizualisation seems out of place here.
- Page 3: “where decades of good life are lost compared to otherwise similar non-smokers”. Should this be “quality life”?
- Page 3: “Cigarettes that are no more than 75 mm”- should be ‘less than’ rather than ‘no more than’.
- Methodology section: Is the routinely collected data being used in this analysis available in other LMICs too?
- Table 1 – just fix strange breadth of columns.
- Page 12, sentence “When rising income is taken into account, both cigarettes and bidis have not become less affordable between 2000 and 2018”. I understand that affordability is a difficult concept to describe, but can one write this in a more intuitive way? For instance, “affordability has remained unchanged over this period”, or even become more affordable.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Economics of tobacco control



**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Reviewer Report 05 February 2019

<https://doi.org/10.21956/gatesopenres.13990.r26873>

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**Shreelata Rao Seshadri**

Azim Premji University, Bengaluru, India

### **General Comments:**

The paper deals with a critical public health issue, using data not commonly utilized to study trends in tobacco prices and taxes. The visualization of the data is interesting, and makes it accessible to the general reader. The paper contributes importantly to evidence that supports decision-making on tobacco taxation policies, an area that needs a lot more attention in India. It also highlights the inter-state variation in the application of taxation as a tool to influence smoking tobacco consumption. However, while arguing for higher taxes, the paper makes no mention of the impact of this policy decision on (i) consumption levels and decisions to quit, (ii) uptake of alternative tobacco products, and (iii) tobacco consumption choices across different demographic strata. Such issues complicate the impact of tobacco control measures, and an acknowledgement of this complexity would have added richness to the analysis.

### **Specific comments:**

1. When mentioning the Framework Convention on Tobacco Control in the Introduction, the authors may also mention that India has adopted the Cigarettes and Other Tobacco Products Act (COTPA, 2003), which does not deal with tobacco taxation, but does make important provisions against smoking in public places, as well as advertisement and sales of smoking tobacco. These have also been found to be effective tobacco control interventions (DCP3), although tobacco taxation is potentially the most effective. Particularly when price increases threaten sales, the aggressive marketing of tobacco products in new geographies and demographics (particularly among adolescents) is a serious possibility. In such a circumstance, provisions against promotion and advertising and in favor of information campaigns have a positive impact.
2. The paper shows an increase in affordability of cigarettes and bidis by comparing the Consumer Price Index for tobacco to GDP per capita. The implication here is that greater affordability will lead to greater tobacco consumption. Yet recent survey data show (National Family Health Survey Rounds 3 and 4 - [http://rchiips.org/nfhs/factsheet\\_nfhs-4.shtml](http://rchiips.org/nfhs/factsheet_nfhs-4.shtml)) that tobacco consumption among men 15-49 years of age in India overall, and in both Rajasthan and Uttar Pradesh have reduced between 2005/06 and 2015/16: from 57.0 to 44.5% in India, 60.4 to 46.9% in Rajasthan and from 64.3 to 53.0% in Uttar Pradesh. Also, a large proportion of men in this age group have tried to quit tobacco in the 12 months preceding the survey: 30.6%, 25.8% and 38.7% for India, Rajasthan and Uttar Pradesh respectively. This seems to indicate that something other than price and affordability are driving consumption behavior.

3. The impact of increasing cigarette and bidi taxes on switching to alternative tobacco products needs to be mentioned. Consumption of non-smoking tobacco exceeds consumption of smoking tobacco across the board in India. For example, 34.2% of men aged 15-49 in Rajasthan consume ghutka and khaini as compared to 26.5% who consume cigarettes and bidis. The same is true in Uttar Pradesh: 45.7% consuming ghutka and khaini versus 28.4% consuming cigarettes and bidis. If taxes are raised to the point where cigarettes and bidis become unaffordable, a recommendation of the paper, what does the evidence say about the adoption of alternative tobacco products instead? Given the lethal impact of chewing tobacco in terms of oral and other cancers, the policy implications may not be linear.
4. The above point is particularly critical for those groups whose tobacco product of choice is the chewing variety, such as women. Three times as many women chew tobacco with ghutka or paan masala as smoke bidis in Rajasthan (3.6% vs 1.3%) and four times as many in Uttar Pradesh (4% vs 1%). The impact of taxation on smoking tobacco would be minimal in this context.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** I have been working on public health issues in India and other low- and middle-income countries for 25 years. I have engaged extensively with health sector priority setting and resource allocation, as well as risk factors associated with the social determinants of health.

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Reviewer Report 31 January 2019

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**Rijo M. John**

Centre for Public Policy Research (CPPR), Kochi, India

### General Comments:

This paper is an excellent repository of data on trends in prices and taxes of bidis and cigarettes in India over a long period. The authors have meticulously collated this data from different secondary sources which are usually difficult to access for most people and putting them together in one place. This can be an important reference for researchers, policy makers and civil society organizations. Hence, it is important that the presented data is fully accurate. However, there are few places where the paper needs revision to make the presented data fully accurate and consistent with the available secondary sources.

### Specific Comments:

1. Introduction 2<sup>nd</sup> Paragraph: Please clarify that not only the Basic Excise Duty (BED), but other taxes such as National Calamity Contingent Duty (NCCD) and Additional Duties of Excise (health cess) applied on cigarettes also vary by length and filter.
2. Introduction 2<sup>nd</sup> Paragraph: The article says “in June 2018, the specific cigarette tax on the most popular filter cigarettes (> 60 to 70 mm) was approximately 28 Rupees”. Please note that the cigarette tiers for the purpose of taxation is defined for <65 mm, 65-70mm, 70-75mm and 75mm & above. The excise tax varied for each of these tiers. It is not clear where the Rs.28 came from or which tax tier it refers to. Moreover, the Goods and Services Tax (GST) was introduced in June 2017. Which means in June 2018 it is the GST that is in place and the specific tax the article refers to is part of what is called a compensation cess under the GST. Because the authors discuss about specific excise taxes on cigarettes in the same paragraph, the readers may inadvertently believe this Rs. 28 is also a specific excise tax when it is actually not.
3. Introduction 2<sup>nd</sup> Paragraph: Article says “all State VATs were repealed and replaced by a national Goods and Services Tax (GST)” – Please clarify not only the VAT but other taxes like BED, health cess, bidi workers welfare cess etc. were also subsumed into GST except NCCD.
4. Method--self-reported unit values: The 58<sup>th</sup> round of NSS also collected data on consumer expenditures and it is not clear why this particular round of data was not included in the analysis in the paper.
5. Table 1 last row: the values specified against the year 2017/18 are not central excise figures unlike what the table heading suggests. GST on cigarettes now consists of a standard GST rate (28%), a compensation cess that has both ad valorem and specific components (both vary by length of cigarettes) and NCCD (varying by length of cigarettes). The values presented in the last row are the sum of compensation cess—specific part—under the GST and the NCCD. These are not excise taxes as the excise taxes are subsumed into the GST. The additional 5% and 36% applied are also part of the compensation cess under the GST and not excise.

6. Figure 1: This figure should make it clear whether there has been any real tax increase on bidis during the same time period. Whereas the figure shows major tax policy changes for cigarettes, such information is missing for bidis. Yet, we see that the series for both bidis and cigarettes moves in more or less the same direction. Has the bidi prices kept up with cigarette prices despite not having any tax increases during this period or has there been any significant tax increases on bidis corresponding to tax increases on cigarettes during this time? This is an information the authors should provide.
7. The title of figure 1 says there are three series; CPI-IW for bidis, cigarettes and all-items. However, the figure shows the series only for bidis and cigarettes.
8. The footnote to Figure 1 says “National GST introduced (28%); all state-VATs repealed; 21-24% real tax increase on cigarettes”: First of all, not only the state –VATs but also the central excise was subsumed in GST. Secondly, it is incorrect to say there has been about 21-24% real tax increase on cigarettes post GST. The GST council had the goal of making tax rates largely revenue neutral post GST and the effective difference in tax burden between pre and post GST on cigarettes, and to an extent on bidis, were largely negligible. A recent paper which specifically examined the impact of GST on taxation of tobacco products in India<sup>1</sup> concluded that tax burden increased by only 0.14 percentage points post GST on cigarettes. A simple comparison of absolute rates prevailed prior to GST and post GST may inadvertently imply a significant increase in tax. However, pre-GST, the VAT was computed on the excise inclusive price whereas, under the GST, such tax on tax is fully done away with. As a result, the effective tax burden remains more or less the same for cigarettes before and after GST.
9. Figures 3a & 3b: From the financial year 2013-14 VAT rates on cigarettes and bidis went up to 65% from the previous year’s 50% in Rajasthan and not 60% as shown in these figures. Moreover, from the financial year 2014-15 onwards, Rajasthan introduced specific taxation instead of ad valorem taxes, for cigarettes. The authors have, however, not indicated this anywhere on the graph.
10. Figures 4a & 4b: From the financial year 2012-13 VAT rates on cigarettes went up to 55% (including a 5% additional tax) from the previous year’s 17.5% in Uttar Pradesh and it decreased to 30% (including 5% additional tax) in the subsequent year. It again went up to 45% in FY 2015-16. For bidis, however, such VAT changes have not happened during this time. It remained at 13.5% throughout this period. The authors should correct the figures accordingly.

## References

1. John RM, Dauchy E, Goodchild M: Estimated impact of the GST on tobacco products in India. *Tob Control*. 2018. [PubMed Abstract](#) | [Publisher Full Text](#)

## Is the work clearly and accurately presented and does it cite the current literature?

Yes

## Is the study design appropriate and is the work technically sound?

Yes

## Are sufficient details of methods and analysis provided to allow replication by others?

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** I have been working on economics of Tobacco control in India and other low and middle income countries for nearly 15 years. I have extensive research experience on tobacco taxation in India and have published several research papers using similar data this article compiles.

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

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