

CIGARETTE AFFORDABILITY IN CHINA

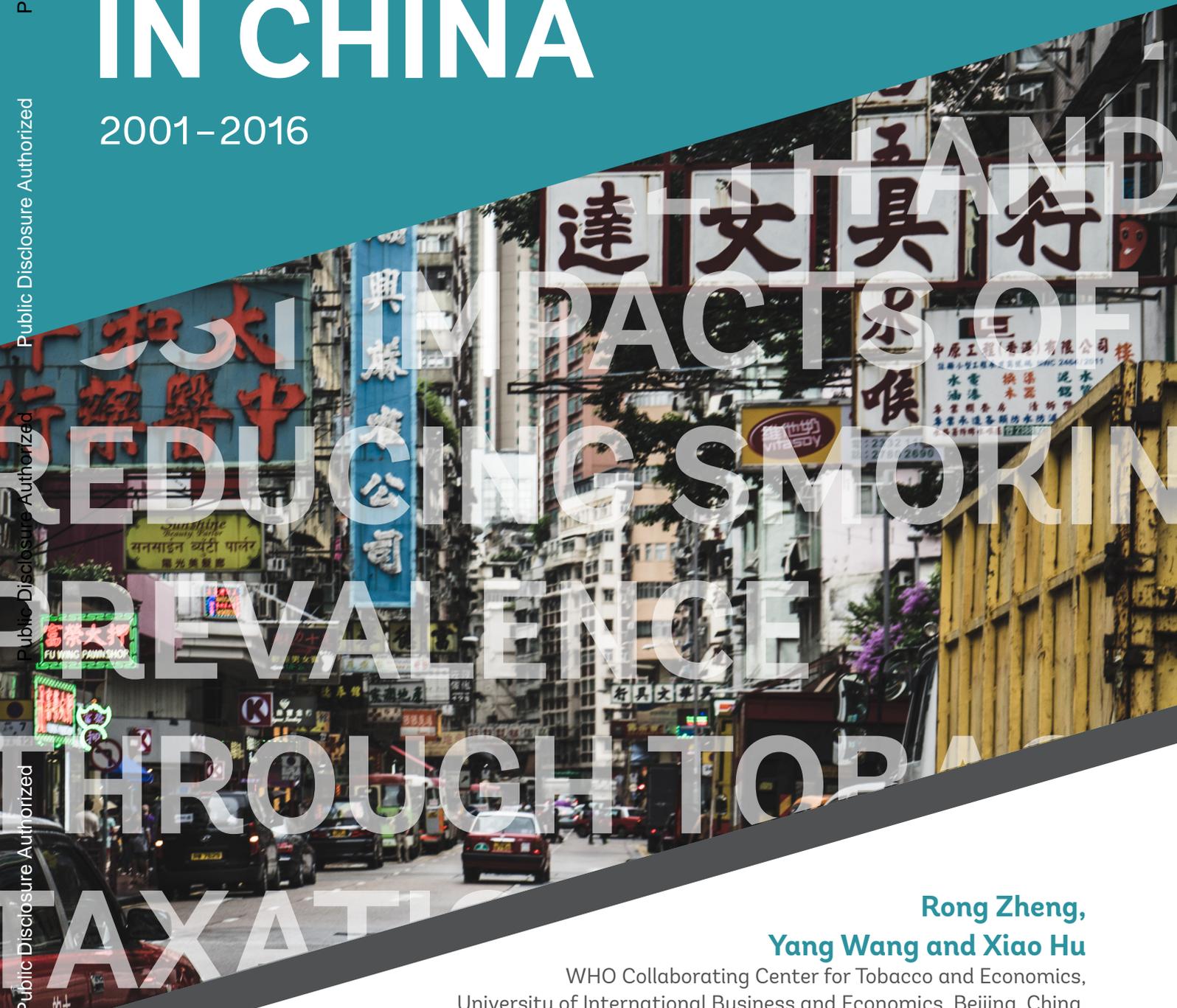
2001–2016

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IMPACTS OF
REDUCING SMOKING
PREVALENCE
THROUGH TOBACCO
TAXATION

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“An all-around moderately prosperous society cannot be achieved without the people’s all-around health.”

“So prevention should be more important than treatment.”

“If these issues are not addressed effectively, the people’s health may be seriously undermined, and economic development and social stability will be compromised”

**Xi Jinping, President
Peoples Republic of China**

National Meeting on Health attended by all members of the Standing Committee of the Political Bureau of the Communist Party of China Central Committee, August 2016.

Among various tobacco control policies, taxation has been shown to be an effective means to reduce tobacco consumption, reduce the risk of tobacco-related diseases and premature death, and thus to reduce health care costs, while generating a steady and reliable revenue stream to finance sustainable development.

Abstract

This study investigates the affordability of cigarettes in China between 2001 and 2016. In the past two decades, China has achieved unprecedented economic growth rates. The country's per capita GDP has increased at an average annual rate of 10 percent. Rapid economic growth increases people's purchasing power and makes cigarettes more affordable, as income gains overrun cigarette price increases.

Our results show that average-price cigarettes in China were 1.85 times more affordable in 2016 than in 2001, while the cheapest category of cigarettes, typically consumed by low-income persons, became 2.09 times more affordable over this period. Thus, cheap cigarettes aimed at low-income Chinese consumers exhibit higher levels of affordability, and have increased their affordability faster, than other cigarettes aimed at average-income consumers. The study estimates the affordability elasticity of cigarette consumption in China at -0.6, suggesting that a 10 percent increase in cigarette affordability will result in 6.01 percent increase in cigarette consumption.

Cigarette affordability in China has also increased in comparison with other countries. China's cigarette affordability was still at a low level compared with other countries in the 1990s, but increased quickly and to a high level within just two decades.

Findings from this study have important implications for tax policy, pertaining to tobacco prices and tobacco control. These findings confirm that for tax increases to reduce the number of smokers and deaths in China, policy makers need to review the potential effects of rising income and prices with a focus on reducing cigarette affordability. It is also important to look at affordability not only on average but by income group—in this study proxied by using average and rural incomes.

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Abbreviations

CAI: Cigarette Affordability Index

CPDIR: Cigarette Price / Daily Income Ratio

China CDC: Chinese Center for Disease Control and Prevention

GDP: Gross Domestic Product

HIC: High-Income Country

IPC: Income Purchasing Capacity

LIC: Low-Income Country

LMIC: Lower Middle-Income Country

MoL: Minutes of Labor

NCI: National Cancer Institute

RIP: Relative Income Price

STMA: State Tobacco Monopoly Administration

UMIC: Upper Middle Income Country

WHO: World Health Organization

Key Legislation and Regulations

FCTC: WHO Framework Convention on Tobacco Control

FCTC Article 6: Price and tax measures to reduce the demand for tobacco

Acknowledgments

This report was prepared by a team comprised of Rong Zheng, Yang Wang, and Xiao Hu, WHO Collaborating Center for Tobacco and Economics, University of International Business and Economics, Beijing, China. and Patricio V. Marquez, The World Bank Group, Health, Nutrition and Population Global Practice, Washington, DC, USA.

Support for the preparation of this study was provided by the World Bank's Global Tobacco Control Program, co-financed by the Bill & Melinda Gates Foundation, the Bloomberg Foundation, and the National Natural Science Foundation of China (Grant No. 71373045).

The authors would like to thank the following peer reviewers for their insightful comments and valuable suggestions that helped to improve an earlier draft of the report:

- **Paul Isenman**, former senior manager with the OECD/DAC Secretariat, the World Bank Group, and USAID
- **Vito Tanzi**, former Director of the Fiscal Affairs Department of the International Monetary Fund (IMF)
- **Teh-wei Hu**, Professor Emeritus, School of Public Health, University of California, Berkeley, and now Director of the Public Health Institute's Center for International Tobacco Control, Berkeley, California
- **Konstantin Krasovsky**, Head, Tobacco Control Unit, Ministry of Health of Ukraine
- **Feng Zhao**, Human Development Program Leader for Ukraine, Belarus and Moldova, World Bank Group
- **Shiyong Wang**, Senior Health Specialist, World Bank Group
- **Francisco Meneses**, Duke University
- **Alexander Irwin** served as Editor of the report

The findings, interpretations, and conclusions in this paper are entirely those of the authors. They do not necessarily represent the views of the World Bank Group, its Executive Directors, or the countries they represent.

**Beijing, China, and Washington, D.C., United States,
December 2016–April 2017**

Introduction

China is the world's largest consumer and producer of tobacco. One-third of cigarettes in the world are consumed in China (Hu et al. 2010). Smoking has had tremendous health and economic consequences for the country. Among various tobacco control policies, taxation has been shown to be an effective means to reduce tobacco consumption and thus to reduce health care costs, while generating a steady and reliable revenue stream to finance sustainable development. Increasing tax and price can reduce demand for tobacco products, but the effectiveness of price increases as a deterrent to tobacco use depends on how much the price rises in relation to the income of current and potential tobacco users, as well as with respect to inflation. The price of tobacco products in relation to the income of tobacco users—that is, affordability—is therefore a key determinant of tobacco-use behavior (Nigar et al. 2016).

The FCTC has made a clear provision for taking affordability into account in setting tobacco tax policies. Article 6 guidelines recommend that: “When establishing or increasing their national levels of taxation, Parties should take into account—among other things—both price elasticity and income elasticity of demand, as well as inflation and changes in household income, to make tobacco products less affordable over time in order to reduce consumption and prevalence. Therefore, Parties should consider having regular adjustment processes or procedures for periodic revaluation of tobacco tax levels” (WHO 2014a).

The past two decades have witnessed rapid economic growth in China, with per capita GDP growing at a rate of nearly 10 percent per year, while Chinese people's incomes and purchasing power have also risen substantially. Cigarette consumption has likewise increased dramatically, despite the Chinese government's efforts in raising the tobacco excise tax in 2009 and 2015. This pattern suggests that cigarettes have become increasingly affordable. Few previous studies have examined cigarette affordability in China, despite substantial variation in cigarette prices and incomes, as well as in their trends over time. This study examines cigarette affordability in China and the correlation with increased consumption. It also compares the changes in cigarette affordability in China over time with changes in other countries.

The findings of this study will provide supportive evidence to Chinese policy makers for a shift from price-based policy solutions to affordability-based policy solutions, with the aim of making cigarettes less affordable. This will involve raising taxes so that the nominal price of cigarettes increases by more than the sum of the inflation rate and the real per capita income growth rate

Literature Review

Affordability refers to an individual's purchasing power with regard to a product. Over the past decades, various methodologies have been developed, defining cigarette affordability as a function of cigarette price and individuals' income levels, with reference to the quantity or share of resources required to buy a pack of cigarettes. Scollo (1996) and Lal and Scollo (2002) developed the "relative price of cigarettes expressed in Big Mac terms," evaluating cigarette affordability in 30 developed countries. China, of course, was not included in the sample list. Guindon et al. (2002) defined affordability by Minutes of Labor (MoL), which is how many working minutes are needed to buy a pack of local-brand or Marlboro (or equivalent) cigarettes. In this study, Chinese people needed to work 61.8 minutes to purchase a pack of Marlboros and 56.2 minutes to buy a pack of local-brand cigarettes in 2000, suggesting a low affordability level. Kan (2007) developed the cigarette price/daily income ratio (CPDIR) to evaluate cigarette affordability by calculating the percentage of daily income needed to buy a pack of cigarettes. Shanghai and Beijing were included in Kan's study, which found that both cities had a low level of cigarette affordability in 2006. Blecher et al. (2004) established Relative Income Price (RIP) as the measurement indicator of cigarette affordability. Blecher's RIP result listed China as the lower middle-income country (LMIC) where cigarettes were least affordable in the period from 1999 to 2001.

Hu et al. (2008) created a cigarette affordability index (CAI), which captures the magnitude of cigarette affordability change in China. The results showed that cigarette affordability in China increased 2.34 times between 1990 and 2007 (Hu et al. 2010).

WHO (2015) compared changing rates of cigarette affordability (defined by RIP) between 2008 and 2014 for selected countries. The rate of increasing cigarette affordability in China was the highest among the countries studied. Another recent study of 49 sample countries also found that China's rate of cigarette affordability increase was the fastest among the countries considered from 2000-2013 (U.S. NCI and WHO 2016). The examination of

affordability change rates explains why, despite the fact that cigarettes remain less affordable in LMICs compared with high-income countries (HICs) overall, changes in affordability over time have led to a decrease in consumption of cigarettes in HICs but an increase in the rest of the world (U.S. NCI and WHO 2016).

Some of the studies listed above examined the level of Chinese cigarette affordability for a period during the 1990s and the first half of the 2000s. Cigarette affordability in China as revealed in these studies presented a low level compared with other countries. These studies also describe an increasing trend in cigarette affordability in China from the 1990s through the 2000s, with China exhibiting the fastest rate of increase in cigarette affordability worldwide.

The above studies took China as one of a number of sample countries for global comparison of cigarette affordability. To date, no study has focused specifically on China to analyze the country's cigarette-affordability level and the magnitude of cigarette-affordability trends by time series since China joined the FCTC in 2005. Nor have existing studies characterized the current level of cigarette affordability in China by global comparison.

The current study investigates cigarette affordability in China during the period from 2001 to 2016 with several objectives. Our research: (1) examines cigarette affordability in China both according to average prices and specifically for the cheap cigarette brands consumed by low-income persons; (2) estimates the correlation between cigarette affordability and cigarette consumption; (3) identifies the level and magnitude of cigarette-affordability increase in China from a global comparison perspective; and (4) explores various tobacco tax policy implications pertaining to tobacco price and tobacco control.

Sources and Methods

Among all methods applied in previous studies, the RIP method (which defines cigarette affordability as the percentage of per capita GDP required to buy 100 packs of cigarettes) has several advantages compared with other measures: first, per capita GDP or per capita disposable income nationwide are good indicators of living standard and income; second, these data are commonly available and therefore make it easier to calculate cigarette affordability, compared with other methods applied in previous studies (Blecher et al. 2004); third, every country calculates per capita GDP

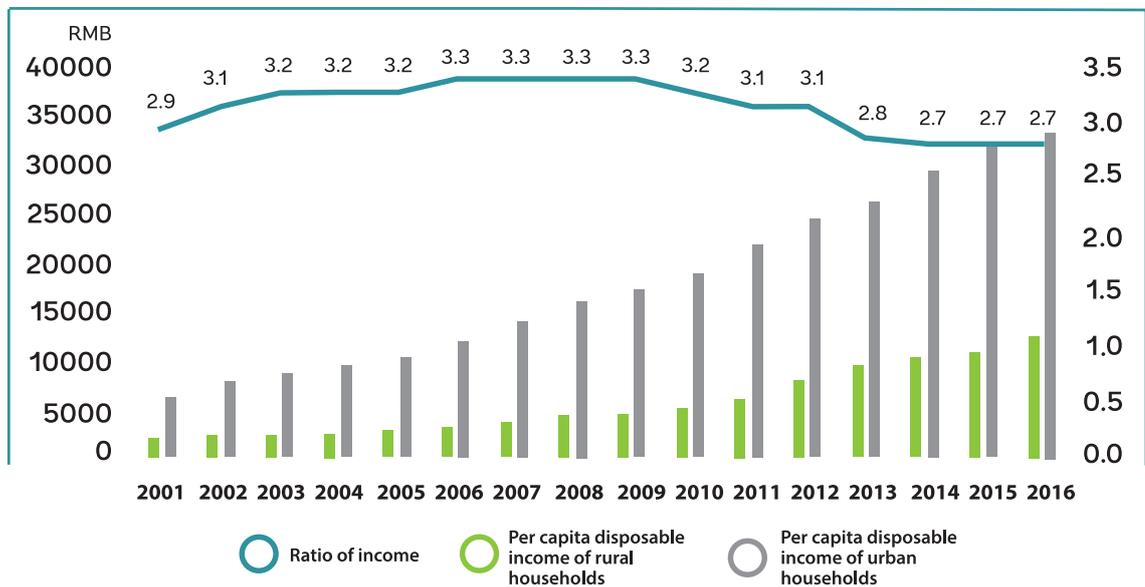
or per capita disposable income nationwide annually using a consistent methodology, thus enabling global comparison of tobacco affordability at country level. The World Health Organization (WHO) has adopted the RIP method, calculating cigarette affordability for all countries with available data (WHO 2015). This makes it possible for our study to identify the current level of cigarette affordability in China compared with other countries.

Taking into account that the Chinese government and state-owned enterprises take a substantial part from social wealth distribution, nationwide per capita disposable income would be much more suitable than per capita GDP for use as an indicator of income. Accordingly, in our study, the RIP method is adapted by replacing per capita GDP with nationwide per capita disposable income.

Previous studies have demonstrated that different income groups respond differently to price-related measures. This has been documented both in high-income countries such as the United States (Hersch 2000) and lower middle-income countries such as Indonesia (Adioetomo et al. 2005). In China, Hu et al. (2008) showed that price-related measures for cigarettes are more effective in low-income groups than in high-income groups.

China's income inequality since 2005 has reached very high levels, with the Gini coefficient in the range of 0.53-0.55. A substantial portion of this elevated income inequality is due to two structural forces: regional disparities and the rural-urban gap (Xie et al. 2014). This creates a situation quite different from that in most other countries. For example, in the United States, individual-level and family-level income determinants, such as family structure and race/ethnicity, play an important role in determining income inequality (McCall et al. 2010). Figure 1 presents the ratio of urban to rural disposable income in China between 2001 and 2016. The difference between average incomes in rural and urban areas has been particularly high in China. In several years between 2001 and 2016, the ratio of urban to rural disposable income reached 3.3 (National Bureau of Statistics of China 2012). This ratio is much higher than in other emerging economies, such as India, where the ratio of consumption between urban and rural households was just under 2 in 2009 (OECD 2012). The inequality between rural and urban areas is linked with disparities in access to basic services—such as medical insurance and education (Herd 2010)—and institutional factors—notably, the hukou system, which prevents rural and urban migrants from acquiring the same rights as people with the local urban registration status in the area in which they live (Herd et al. 2010).

Figure 1: Per capita disposable income of urban and rural households and the ratio of urban to rural per capita disposable income in China



Considering the large disparities in income distribution in China, the use of average income as an indicator may produce a biased result for low-income groups who buy cheap cigarettes. Meanwhile, smoking is more prevalent among low-income groups, such as rural residents, than among urban residents (China CDC 2015). Therefore, when assessing the affordability of cigarettes, particular attention should be given to low-income groups and rural dwellers in China.

Chinese households are categorized by income quintile based on per capita income level. The top 20 percent with the highest incomes are classified as the high-income group, and the other four quintile levels are designated as follows: upper middle-income group, middle-income group, lower middle-income group, and low-income group (National Bureau of Statistics of China 2017).

In 2016, the per capita disposable income of rural Chinese households was 12,363 RMB, while the per capita disposable income of the lower middle-income group of the national population was 12,899 RMB (National Bureau of Statistics of China 2017). Taking into account the equivalence in per capita disposable income between rural households and the lower middle-income group, along with the absence of data on per capita disposable income for the lower middle-income group before 2016, in this study we will use the per capita disposable income of rural households for the affordability analysis of cheap brands consumed by low-income people.

Given the difficulties of evaluating cigarette affordability among different income groups, we propose a dual examination. Our first approach assesses cigarette affordability on average by using the weighted average cigarette price and per capita disposable income nationwide. Our second analysis assesses cigarette affordability specifically for low-income groups by using the price for the cheapest category of cigarettes in China, together with the per capita disposable income of rural households

Cigarette Affordability Definition:

In this paper, we use two methods to define cigarette affordability. One is the RIP method, which defines cigarette affordability as the percentage of per capita disposable income required to buy 100 packs of cigarettes. The higher the RIP, the less affordable cigarettes are, and vice versa. Equation (1) demonstrates the RIP rationale.

$$\text{RIP} = \frac{100 \times P}{\text{Disposable Income}_{\text{per capita}}} \quad (1)$$

where RIP represents the relative income price of cigarettes, and P is the retail price of a pack of cigarettes with 20 individual pieces. In subsequent parts of this report, “RIP average” represents the percentage of nationwide per capita disposable income required to buy 100 packs of weighted average-price cigarettes, and “RIP cheap brands” represents the percentage of the per capita disposable income of rural households required to buy 100 packs of the cheapest available brand of cigarettes.

In this paper we introduce another method for assessing affordability, which measures how many packs of cigarettes could be purchased with the per capita disposable income in a given setting. For lack of a better term, the result is called the income purchasing capacity (IPC). The higher the IPC, the more affordable cigarettes are, and vice versa. Equation (2) demonstrates the IPC rationale.

$$\text{IPC} = \frac{\text{Disposable Income}_{\text{per capita}}}{P} \quad (2)$$

where IPC represents the income purchasing capacity of cigarettes, and P is the retail price of a pack of cigarettes with 20 individual pieces. In our subsequent discussion, “IPC average” will refer to the number of packs of average-price cigarettes that could be purchased with the nationwide per capita disposable income, while “IPC cheap brands” will refer to the number of packs of the cheapest brand of cigarettes that could be purchased with the per capita disposable income of rural households.

Both the RIP and IPC methods can be used to examine levels and trends in cigarette affordability. When applied to the same data, the RIP and IPC methods produce exactly the same results. Our reasons for introducing the IPC method are as follows. (1) The IPC trend is consistent with the cigarette affordability trend, whereas RIP presents an opposite trend to cigarette affordability, i.e., when RIP goes up, affordability goes down. Thus, IPC better describes the correlation between affordability and consumption. (2) While RIP represents the cost of cigarettes as a percentage of income, IPC more simply reflects the number packs of cigarettes that someone could afford to buy with a given income in hand. Rooted in the everyday model of a simple transaction, IPC may be easier for non-specialists, including the general public, to grasp. Thus, IPC may be a more intuitive, “natural” measure for use in policy dialog and advocacy.

In this paper, we also use the Cigarette Affordability Index (CAI) to measure the magnitude of cigarette-affordability change during the whole observed period.

$$CAI_t = \frac{RIP_{2001}}{RIP_t}, \quad \text{where } t = 2001, 2002 \dots 2016 \quad (3)$$

Equation (4) demonstrates the CAI rationale for the IPC method.

$$CAI_t = \frac{IPC_t}{IPC_{2001}}, \quad \text{where } t = 2001, 2002 \dots 2016 \quad (4)$$

Price Data:

Weighted average cigarette price for each year is calculated using the WHO TaXSiM China model. The cheapest-category price for each year is the representative price of the cheapest category applied in the WHO TaXSiM China model.^c Normally, TaXSiM is based on data for all cigarettes (or at least covers 80 percent of the market) when applied in a country. However, given that there are 870 different types of cigarettes in China, with large price variations, a methodology including all cigarettes is not feasible with TaXSiM China. To solve this problem, the TaXSiM China model selects a representative cigarette for each price category, using the market share of each price category to calculate the weighted average price, weighted average tax incidence, etc. The selection criteria for choosing the representative cigarettes

c. WHO TaXSiM is designed to describe the current market and tax situation for domestically consumed cigarettes within a particular country or tax jurisdiction, and then to forecast the impact of tax changes on final consumer prices, annual consumption volumes, and tax revenues for the Government (WHO 2014b). The WHO TaXSiM China model was jointly developed by WHO PND/TCE, the Tax Policy Department of the Chinese Ministry of Finance, and the WHO Collaborating Center on Tobacco and Economics, based in Beijing, China.

are: (1) the selected brand has a large market share in each price category, and (2) the price of the representative cigarette is the median or very close to the median price in each category. The price information on representative cigarettes is sourced from the Annual Cigarette Price List produced by the China State Tobacco Monopoly Administration (STMA).

Income Data:

Income data come from the National Bureau of Statistics of China. Because there were no nationwide per capita disposable income data published by the National Bureau of Statistics before 2013, the nationwide per capita disposable income data for each year during the period 2001-2012 are calculated from per capita disposable income for urban households and per capita net income for rural households, sourced from the Chinese National Bureau of Statistics, using the population ratio of urban residents and rural residents, respectively, as the weight. Data between 2013 and 2016, including nationwide per capita disposable income, per capita disposable income for urban households, and per capita disposable income for rural households, are sourced from the National Bureau of Statistics of China.

Results

Affordability: Level, Trend, Magnitude of Change, and Growth rate

Using the per capita disposable income and cigarette price information described, we performed a dual examination on cigarette affordability for weighted average-price and cheap cigarette brands between 2001 and 2016, with the following aims: (1) estimate the levels of cigarette affordability in each year; (2) present the trends of cigarette affordability through the period; (3) calculate the magnitudes of cigarette affordability change; and (4) examine the annual growth rates, as well as the fixed-base growth rates.

Table 1 presents the level of average cigarette affordability (RIP average and IPC average) and the magnitude of average cigarette-affordability change (CAI average) between 2001 and 2016. The RIP average lists the cost of 100 packs of weighted average-price cigarettes as a percentage of nationwide per capita disposable income in each year. The IPC average lists the number of packs of cigarettes that could be purchased with the nationwide per capita disposable income in each year. CAI average lists the magnitude of the nationwide affordability change on average in each year compared with the base year of 2001.

Table 1: Cigarette affordability on average: RIP average, IPC average, and CAI average

YEAR	WEIGHTED AVERAGE PRICE (RMB/PACK)	PER CAPITA DISPOSABLE INCOME NATIONWIDE (RMB)	RIP AVERAGE (%)	IPC AVERAGE (PACKS)	CAI AVERAGE
2001	4.12	4058.52	10.15	985	1.00
2002	4.32	4518.90	9.56	1046	1.06
2003	4.61	4993.22	9.23	1083	1.10
2004	5.04	5644.62	8.93	1120	1.14
2005	5.63	6366.57	8.84	1131	1.15
2006	6.25	7210.91	8.67	1154	1.17
2007	6.43	8566.60	7.51	1332	1.35
2008	6.14	9938.92	6.18	1619	1.64
2009	6.71	10964.57	6.12	1634	1.66
2010	7.27	12507.58	5.81	1720	1.75
2011	9.33	14581.95	6.40	1563	1.59
2012	10.27	16668.53	6.16	1623	1.65
2013	10.80	18310.76	5.90	1695	1.72
2014	11.61	20167.12	5.76	1737	1.76
2015	12.81	21966.19	5.83	1715	1.74
2016	13.09	23821.00	5.50	1820	1.85

Table 2 presents the level of cigarette affordability for the cheap brands primarily consumed by low-income groups (RIP cheap brands and IPC cheap brands) and the magnitude of cigarette affordability change for cheap brands (CAI cheap brands) between 2001 and 2016. The “RIP cheap brands” shows the cost of 100 packs of cheap-brand cigarettes as a percentage of the per capita disposable income of rural households in each year. The “IPC cheap brands” shows the packs of cigarettes that could be purchased with the per capita disposable income of rural households in each year. “CAI cheap brands” measures the magnitude of the affordability change relative to the base-year level (2001) for the cheap brands consumed by low-income groups.

Table 2: Cigarette affordability of cheap brands: RIP cheap brands, IPC cheap brands, and CAI cheap brands

YEAR	CHEAPEST CATEGORY PRICE (RMB/PACK)	PER CAPITA DISPOSABLE INCOME OF RURAL HOUSEHOLDS (RMB)	RIP CHEAP BRANDS (%)	IPC CHEAP BRANDS (PACKS)	CAI CHEAP BRANDS
2001	1.20	2366.40	5.07	1972	1.00
2002	1.20	2475.60	4.85	2063	1.05
2003	1.20	2622.20	4.58	2185	1.11
2004	1.20	2936.40	4.09	2447	1.24
2005	1.40	3254.90	4.30	2325	1.18
2006	1.40	3587.00	3.90	2562	1.30
2007	2.00	4140.40	4.83	2070	1.05
2008	2.50	4760.60	5.25	1904	0.97
2009	2.50	5153.20	4.85	2061	1.05
2010	2.00	5919.00	3.38	2960	1.50
2011	2.50	6977.30	3.58	2791	1.42
2012	2.50	7916.60	3.16	3167	1.61
2013	2.50	9429.59	2.65	3772	1.91
2014	2.50	10488.88	2.38	4196	2.13
2015	3.00	11421.71	2.63	3807	1.93
2016	3.00	12363.00	2.43	4121	2.09

Figure 2 and Figure 3 present the levels of cigarette affordability of the average and cheap brands in each year between 2001-2016, expressed respectively by the RIP method and the IPC method. For example, using the RIP method, the cost of 100 packs of weighted average-price cigarettes as a percentage of nationwide per capita disposable income was 5.5 percent in 2016. By the IPC method, meanwhile, nationwide per capita disposable income could buy 1820 packs of average-price cigarettes in 2016.

Both methods demonstrate that cheap cigarette brands had a higher level of affordability than did average-price cigarettes throughout the whole period, which means cheap-brand cigarettes are more affordable for low-income consumers than are other cigarette price categories for average-income groups. This finding runs counter to a number of results from previous research, which have tended to show that cigarettes remain more affordable for high-income groups than for low-income groups. This pattern has been reported both in cross-country studies (Blecher et al. 2009; U.S. NCI and WHO 2016) and at the level of individual countries (Rodríguez-Iglesias et al. 2015)

Figure 2: RIP average and RIP cheap brands

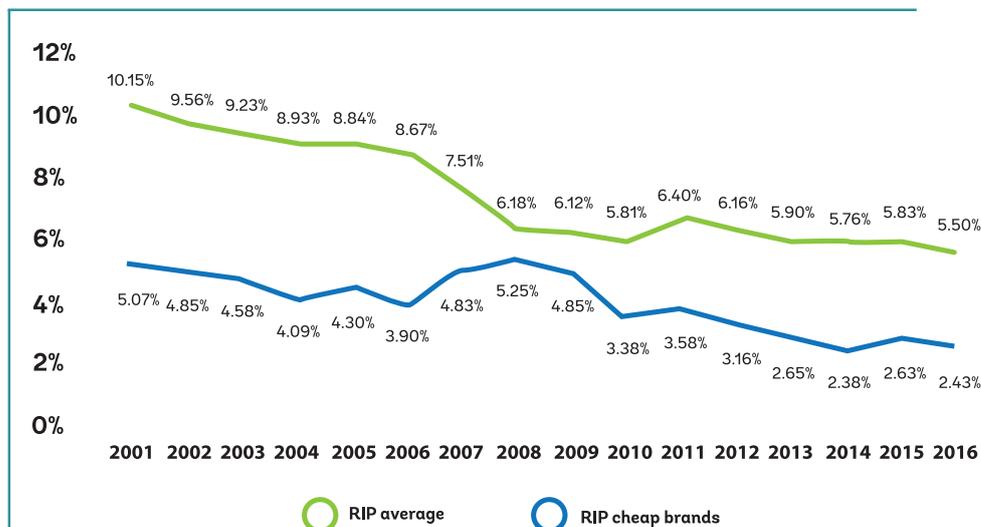
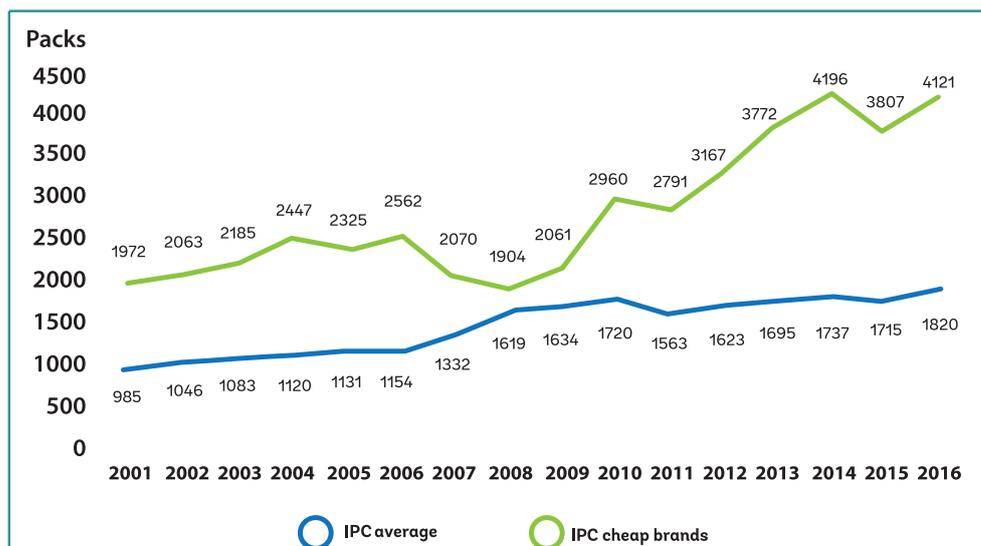


Figure 3: IPC average and IPC cheap brands



Why, then, do the cheap cigarette brands used by lower-income groups exhibit a consistently higher-than-average level of affordability in China?

Figure 4 shows that, through the whole of our study period, the ratio of weighted-average cigarette price to cheapest-category price is higher than the ratio of nationwide per capita disposable income to the per capita disposable income of rural households. This suggests that the price gap between the weighted-average cigarette price and the cheapest price is larger than the income gap between average per capita disposable income nationwide and the per capita disposable income of rural households.

This is due, in particular, to the extremely low price of the cheap cigarette brands in China. For example, in 2016, the price of the cheapest cigarette brands was around 3 RMB (0.43 USD) per pack. The dramatically reduced ratio of weighted-average price to cheapest-category price between 2006 and 2010, depicted in Figure 4, also explains why “CAI average” increased faster than “CAI cheap brands” during this period, as Figure 5 makes clear.

Figure 4: Income ratio vs. price ratio

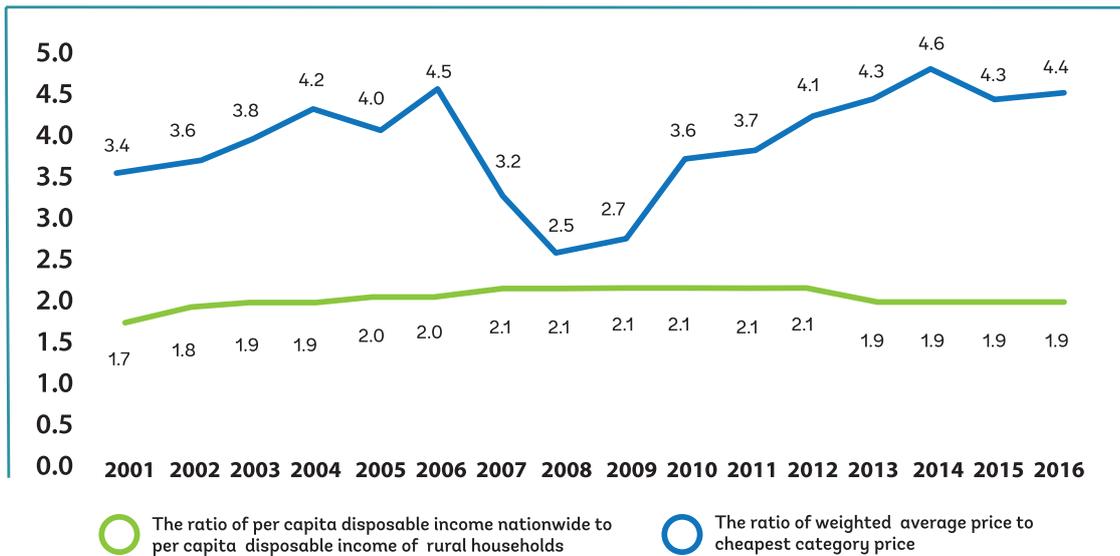


Figure 5 presents the trends and the magnitudes of cigarette-affordability changes for the average and cheap brands, respectively, by CAIs. Both the average and the cheap brands have become more affordable during the period from 2001 to 2016. However, the upward trends are configured differently in the two groups. The affordability of average-price cigarettes presents a steadily increasing trend with only two turning points, in 2011 and 2015, while the affordability trend of the cheap brands presents notable ups and downs. A U shape observed between 2006 and 2010 suggests that cheap brands temporarily became less affordable for potential consumers (primarily low-income people) in this period than in previous years. During the periods 2003-2006 and 2012-2016, in contrast, cheap-brand affordability showed a faster rate of increase than the average. CAI values also show the magnitude of cigarette affordability change. In 2016, for example, cigarettes were 1.85 times more affordable than in 2001, on average. However, cheap-brand cigarettes in 2016 were 2.09 times more affordable than in 2001, indicating that their affordability was increasing faster than the average over the preceding period.

Figure 5: CAI average and CAI cheap brands

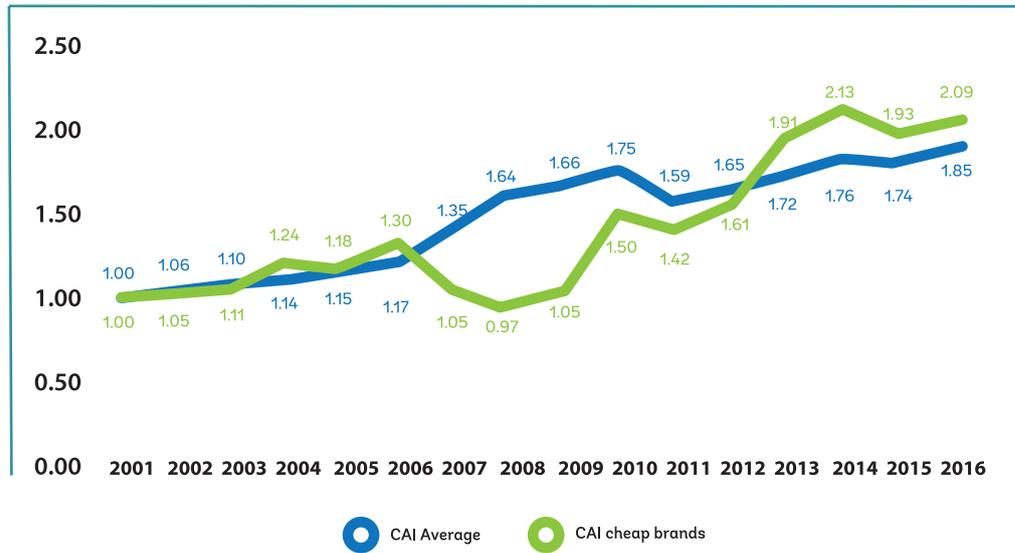


Figure 6 and Figure 7 illustrate the annual growth rates and fixed-base growth rates of cigarette affordability for the average and the cheap brands, respectively. On average, cigarette affordability increased by 85 percent, while the cheap brands' affordability increased by 109 percent between 2001 and 2016. There were two years in which, on average, cigarettes were less affordable than the previous year. This happened in 2011 and 2015. The cheaper brands, in contrast, present a fluctuating annual change, as well as a dramatic fixed-base growth rate.

Figure 6: IPC average annual growth rate and fixed-base growth rate

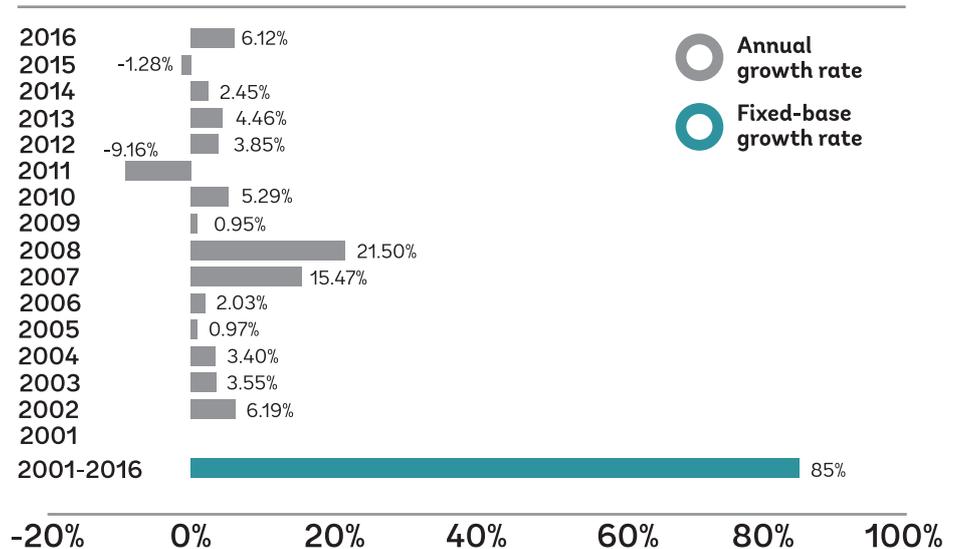
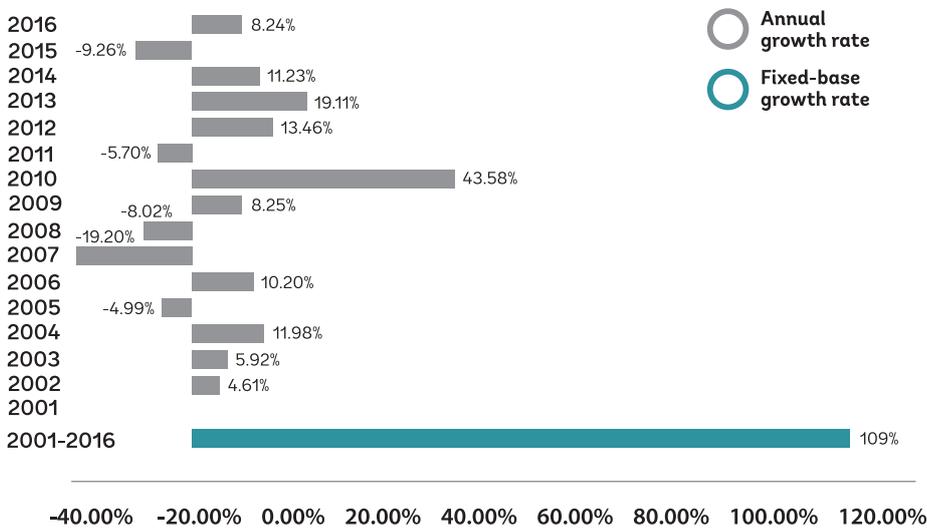
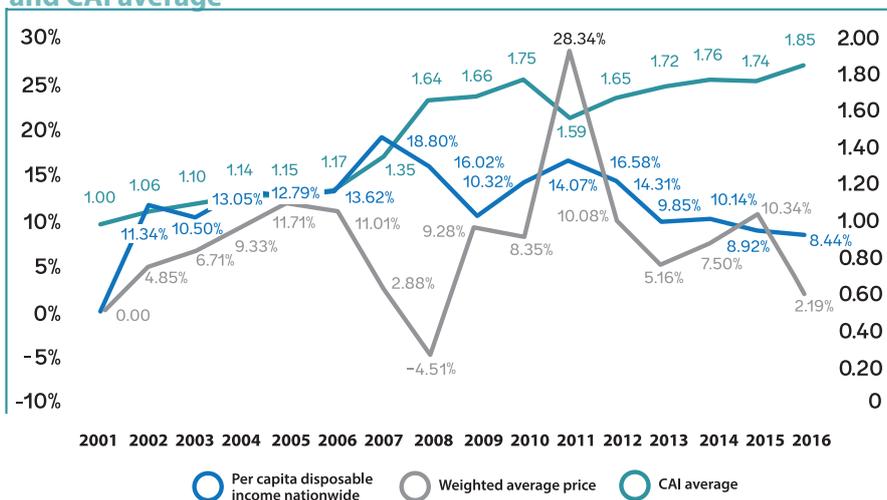


Figure 7: IPC cheap brands annual growth rate and fixed-base growth rate



The trend of cigarette affordability depends on the relative magnitude of the income change and price change. As illustrated in Figure 8, on average, cigarette affordability increases when the annual growth rate of nationwide per capita disposable income exceeds the annual growth rate of weighted-average cigarette price, as happened in most years between 2001 and 2016. On the other hand, when the annual growth rate of weighted-average price outpaces the annual growth rate of nationwide per capita disposable income (which happened in 2011 and 2015), cigarette affordability decreases. So an effective tobacco tax policy must evaluate cigarette affordability regularly, and regular tax increases should be applied to make sure that the nominal price of cigarettes increases by more than the sum of the inflation rate and the real per capita income growth rate.

Figure 8: Annual growth rate of income, annual growth rate of price, and CAI average



The Affordability Elasticity of Demand

The theory of price elasticity of demand suggests that people will generally demand more of a product as the price decreases, assuming other factors (such as incomes, the prices of other substitute goods, and people's tastes) are kept constant (Blecher et al. 2004). More precisely, the price elasticity of demand gives the percentage change in quantity demanded in response to a one percent change in price. It is generally accepted that, on average, a price rise of 10 percent would be expected to reduce demand for tobacco products by about 4 percent in high-income countries and by about 8 percent in low- and middle-income countries (World Bank 1999). Most estimates of the price elasticity of demand from the large literature on high-income countries fall into the relatively narrow range from -0.25 to -0.50, with many clustering around -0.40. In contrast, estimates from the much smaller literature on low-income and middle-income countries suggest that demand in these countries is more responsive to price than demand in high-income countries, with most estimates in the range from -0.50 to -1.00 (Chaloupka 2000).

However, as mentioned above, price and income level will affect cigarette consumption simultaneously. In the same way that changes in prices (rather than the level of prices) are more useful as a tobacco control tool, changes in cigarette affordability (rather than the level of cigarette affordability) are expected to drive changes in cigarette consumption over time (U.S. NCI and WHO 2016).

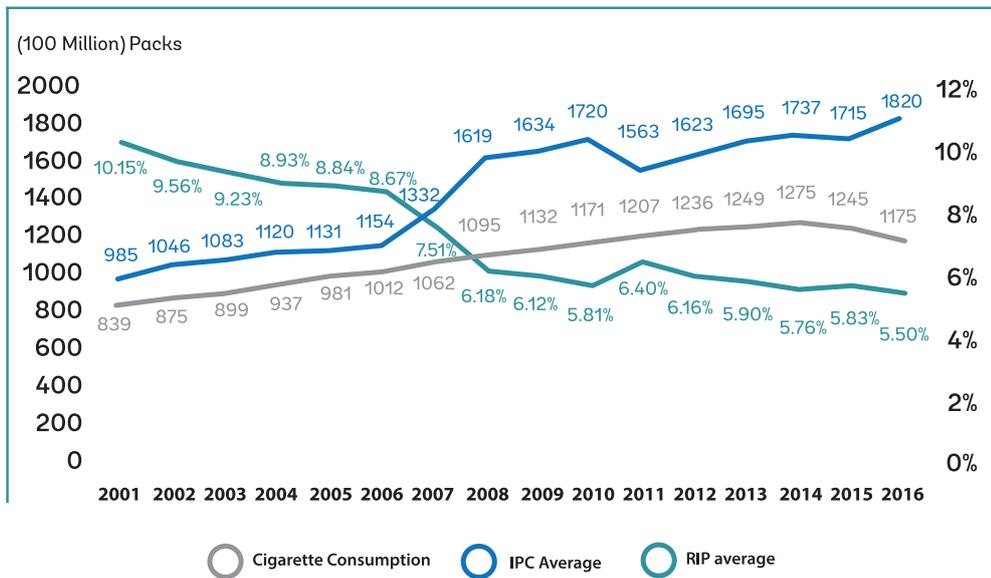
In the context of this study, the relation between cigarette consumption and cigarette affordability will be illustrated by the affordability elasticity of demand, defined as the percentage change in cigarette consumption in response to a percentage change in the RIP. This explains how consumption will change along with RIP changes. Equation (5) is used to quantify the magnitude of the relation between cigarette affordability and consumption.

$$\ln(\text{consumption}_t) = \alpha + \beta \ln(\text{RIP}_t) + \varepsilon_t \quad (5)$$

where consumption represents the cigarette consumption in year t , using consumption data from the China Tobacco Yearbook (STMA); RIP_t represents the Relative Income Price in year t ; and ε_t is the error term. According to the definition of price elasticity, β is the estimator of the affordability elasticity of demand. Using ordinary least squares, β is estimated at -0.601 (95 percent confidence interval -0.716 to -0.487; P value=0.000; $R^2=0.901$). This suggests that if there is a 10 percent increase in the RIP (i.e., equivalent decrease in cigarette affordability), cigarette consumption will decrease by 6.01 percent. On average, the estimated affordability elasticity of demand in China is -0.60,

suggesting that a 10 percent increase in cigarette affordability will bring a 6 percent increase in cigarette consumption. Figure 9 describes the correlation of affordability elasticity and cigarette consumption in China. 2015 saw cigarette consumption in China declining for the first time in two decades. This is particularly due to the tax adjustment, along with a 10 percent price increase in 2015. Other factors contributing to reduced consumption included municipal smoke-free legislation that affected workplaces and public spaces in Beijing and other cities, as well as the government’s anti-corruption efforts.

Figure 9: Cigarette consumption, IPC average, and RIP average

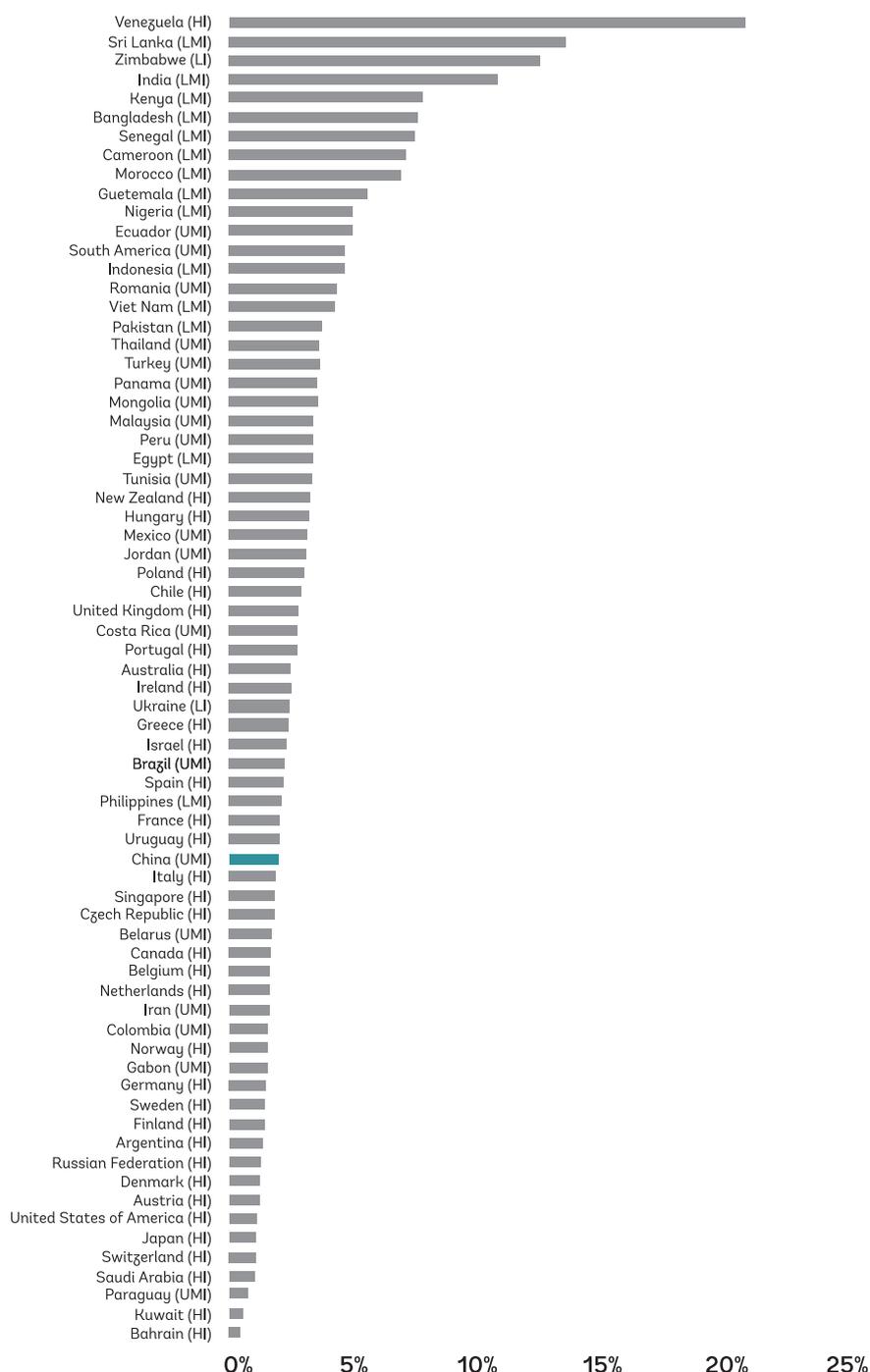


Global Ranking of Cigarette Affordability

Blecher’s study ranks cigarette affordability measured by RIP (the percentage of per capita GDP required to buy 100 packs of cigarettes) among 70 countries between 1999 and 2001. China ranked as the fifth-least-affordable country among 70 counties examined, indicating that cigarette affordability in China at that time was at a very low level compared with other nations (Blecher et al. 2004). In 2014, WHO calculated average RIP for 168 countries with available data. At that time, among all countries studied, China ranked as the 45th-most-affordable country for cigarette use (WHO 2015). Figure 10 ranks cigarette affordability for 70 countries (66 countries overlap with Blecher’s country sampling) based on WHO’s published RIP data (WHO 2015). China’s cigarette affordability ranks 26th-highest among the selected 70 countries. On average, cigarettes are far more affordable in HICs than in LMICs (Blecher et al. 2004, U.S. NCI and WHO 2016). Note, however, that while China is an UMIC, the current level of cigarette affordability in China is higher than that of many HICs. Moreover, within just two decades, China has jumped from the fourth-

quartile affordable-country group to the second-quartile affordable-country group. The growth rate of cigarette affordability in China ranks number one among all observed countries (U.S. NCI and WHO 2016).

Figure 10: Cost of 100 packs of cigarettes as percentage of per capita GDP, 2014



SOURCE

WHO Report on the Global Tobacco Epidemic, 2015. China data is calculated by the authors for the year 2015. Country income group classification based on World Bank Analytical Classifications for 2014 (World Bank 2014).

Main findings from this study include the following:

(1) Cigarettes have become more affordable in China between 2001 and 2016, because income gains have outpaced cigarette price increases. Average-price cigarettes are 1.85 times more affordable in 2016 than in 2001, while cheap-brand cigarettes have become 2.09 times more affordable over the same period. Cheap-brand cigarettes showed a higher level of affordability than average-price categories throughout the period 2001-2016, because cheap-brand prices have remained extremely low.

(2) Changes in cigarette affordability drive changes in cigarette consumption over time. A 10 percent increase in cigarette affordability will result in a 6 percent increase in cigarette consumption in China.

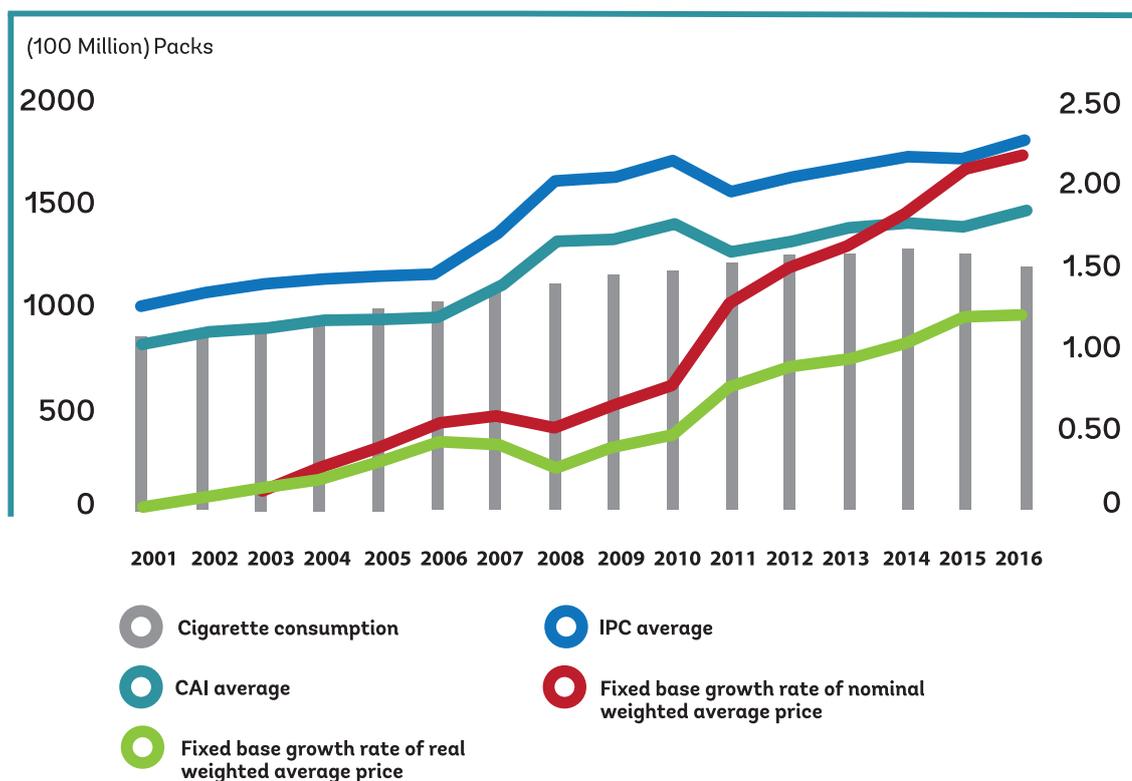
(3) Its current level of cigarette affordability makes China the 45th-most-affordable country for cigarette smoking among 168 countries. In just two decades, China has moved from the fourth-quartile affordable-country group to the second-quartile affordable-country group, as China's cigarette affordability has surged with the fastest growth rate in the world.

All these findings suggest that it is imperative for Chinese policy makers to make a shift from price-based policy solutions to affordability-based policy solutions, with the aim of making cigarettes less affordable.

Discussion

Increasing the tax on tobacco products is arguably the most effective method of curbing the prevalence and consumption of these products. Tobacco control advocates have long promoted higher excise taxes, leading to higher cigarette prices, as a means of reducing cigarette consumption. Between 2001 and 2016, the weighted nominal average cigarette price in China rose by 218 percent, from 4.12 RMB per pack in 2001 to 13.09 RMB per pack in 2016. Meanwhile, the weighted real average cigarette price rose by 121 percent. However, these price increases did not result in tobacco use reduction, as cigarette consumption in China increased by 40 percent during this period (Figure 11). This happened because China experienced rapid economic growth during these years. The country's per capita GDP has increased at an average annual rate of 10 percent for the last two decades. Rapid economic growth increases people's purchasing power substantially. As their income increases, smokers find cigarettes becoming more affordable. For this reason, affordability instead of price should be the focal concern for Chinese policy makers.

Figure 11: Trends in cigarette price, affordability, and consumption



Our results show that cigarettes have become more affordable in China over time. In particular, cheap cigarettes primarily targeted to lower-income smokers have shown a higher affordability level along with relatively greater affordability increases than other price categories of cigarettes, which are mainly targeted to average-income smokers. From a policy perspective, the trends outlined above support the following recommendations:

(1) The increasing affordability trend means that there is ample room to raise tobacco taxes and prices. China will need to design and implement regular tax increases to make sustained progress on tobacco control and public health.

(2) The extremely low price of cheap cigarette brands calls for raising the specific tax substantially in the context of future tobacco tax increases. Authorities may also wish to establish a minimum price for cigarettes, to ensure that cheap cigarettes become less affordable over time. This is particularly relevant for protecting vulnerable smokers, such as youth and people with low incomes.

(3) Greater attention should be paid to ensure that growth in cigarette excise taxes and prices consistently outpaces income growth. In order to maximize public health gains, policy makers may consider introducing index management by considering affordability in benchmarking excise tax increases. This policy strategy is implementable, particularly given the relation between cigarette affordability and cigarette consumption revealed in this study: that a 10 percent increase in cigarette affordability will result in a 6 percent increase in cigarette consumption. Policy makers may also wish to note that, given rapid income growth in China, sharp increases in China's tobacco taxes to keep ahead of rising incomes may disturb cigarette price equilibriums between China and its less rapidly growing neighbors. Increased efforts may thus be required to contain potential cigarette smuggling problems.

The unprecedented economic growth of the past three decades has created great opportunities and brought significant achievements for China and the Chinese people. People's standard of living has improved substantially, as 730 million Chinese people have escaped from extreme poverty since 1990. Impressive economic growth, along with government policies crafted to improve the incomes and livelihoods of the poorest, have enabled this extraordinary progress (Hofman 2016). Yet these economic gains have brought new tobacco control challenges. Economic growth and associated increases in income can weaken tax-based and price-based tobacco control measures designed to reduce tobacco use. Stronger tobacco control measures, including effective tobacco tax policies leading to a reduction in cigarette affordability, are imperative to reduce both the prevalence of smoking in the population and cigarette consumption.

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