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Impact of taxation policy on tobacco consumption in Saudi Arabia

Hawazin Fahad Alotaibi,[a] Nasser Abdullah Alsanea[bc]

From the [a]Health Sector Transformation Program-Health in All Policy-Health Policy Advisor, Riyadh, Saudi Arabia; [b]Department of Surgery, King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia; [c]Director General, Health Affairs, Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia

Correspondence: Hawazin Fahad Alotaibi · Health Sector Transformation Program - Health in All Policy-Health Policy Advisor Riyadh, Saudi Arabia · hawazinalotaibi@gmail.com · ORCID: https://orcid.org/0000-0002-4741-7618

BACKGROUND: Taxes on tobacco products that increase the price and target demand-reduction have been shown to be an efficient means of reducing tobacco consumption. A new policy introduced in 2017 has increased the price of a 20-cigarette pack of the most popular brand to 27.50 SAR (7.33 USD) with the tax portion being 68.09%, which is within the yardstick recommended by the World Bank.

OBJECTIVE: Assess impact of taxes on cigarette consumption.

DESIGN: Retrospective econometric analysis.

MAIN OUTCOMES MEASURES: The annual importation of cigarettes containing tobacco (commodity code 24022000) in metric tons (as a proxy measure of consumption).

METHODS: An econometric analysis of cigarette prices and consumption was performed using the methods of the World Bank Economics of Tobacco Toolkit. The impact was assessed statistically through price elasticity of cigarette demand. The study used yearly data for the period 2013-2019 to compare the price elasticity of demand according to the change in price. Cigarette consumption was equated to cigarette imports (dependent variable), and correlation with the cigarette price, income, education, and unemployment was assessed as independent variables of interest.

RESULTS: Annual importation of cigarettes declined by 27.41% for the period 2013-2019 after the imposition of ad valorem and value-added taxes in 2017 and 2018, respectively. The price of a pack of cigarettes increased by 115.1% from 2016 to 2018. The per capita consumption was inversely correlated with price *P=.0003285, r=-0.969). The inverse correlation between income and per capita consumption was also statistically significant (P=.025, r=-0.816). Education did not correlate with per capita consumption (P=.740, r=-0.155), but unemployment was inversely correlated (P=.008, r=-0.884). From 2016 to 2018, the price elasticity of demand became negative with respect to income as recommended by the World Health Organization. The price elasticity of demand reached -0.07, -0.8, -0.93 in 2016,2017, 2018, respectively.

CONCLUSION: The modification of tax policy in 2017 has resulted in a decrease in both cigarette affordability and consumption. An additional 42.67% increase in the price, or pack price of 35.81 SAR (9.54 USD) might offset the increase in individual income noted in 2019 and maintain the decreased affordability.

LIMITATIONS: The lack of more granular data on cigarette sales and more reliable data on prevalence.

CONFLICT OF INTEREST: None.

Cigarette smoking is ranked among the five leading risk factors in premature deaths based on disability-adjusted life years (DALYs).[1] It kills more than 8 million people yearly.[2-4] The world's economies spend over 1.4 trillion United States dollars (USD) to combat the effects of tobacco smoking, which translates to about 1.8% of the world's annual gross domestic product.[5] According to the World Bank, 15% of health care expenditure in high income countries can be attributed to smoking.[6] Indirect effects of smoking pose considerable indirect costs such as total productivity losses, which were estimated at $151 billion in the United States.[6] In Saudi Arabia, about 70 000 people die annually as a result of cigarette smoking.[7] Smoking was responsible for 280 000 premature deaths between 1996 and 2012.[8] This is the economic burden of tobacco consumption over the last 10 years (2001–2010) in Saudi Arabia was nearly $20.5 billion (USD).[8] Gross domestic product lost due to smoking increased from 0.2% in 2012 to 0.98% in 2016.[7] From 2010 to 2014, the cost of import of cigarettes and other tobacco products to Saudi Arabia was worth $3.4 billion.[9] Saudi ranks in the fourth position in tobacco sales and imports across the world.[10-12] With a population of just 34 million,[13] the demand for tobacco products represents an intensification of cigarette smoking. Previous studies have reported conflicting data on tobacco consumption in Saudi Arabia. According to the World Bank, the prevalence of cigarette smoking has remained relatively the same in the last two decades.[14] In 2013, a national survey revealed that 12.2% of Saudi adults are smokers.[15] In a study published in 2021, 14.1% of the respondents aged 15 years or older smoked cigarettes.[7] The latest survey, conducted by the Saudi Food and Drug Authority in 2018, estimated the adult smoking prevalence at 21.4%.[7] The WHO projects that the male smoking prevalence will reach about 24% by 2025.[12] There is a growing evidence that raising and enforcement of taxes on tobacco products that target demand-reduction has emerged as the most efficient of the WHO Framework Convention on Tobacco Control (FCTC) MPOWER measures.[16-18] The MPOWER tobacco consumption control model comprises six evidence-based measures the convert the overarching goals in the WHO FCTC framework into a simplified smoking policy package.[17] The M- represents the requirement that the signatory parties monitor tobacco use at the national level. The P- stands for protecting society, non-smokers, and minors from tobacco smoke or passive smoking. The O- obliges the relevant governmental agencies to offer assistance to smokers willing to quit cigarette consumption. W- presents obligations to warn tobacco users about the dangers of smoking. E- signifies the enforcement of laws and statutes banning tobacco sponsorship, advertisement, and promotion. The last element stands for R-raising taxes and levies on tobacco use and production to discourage smoking addiction and output.[17] Before 2002, Saudi Arabia lacked a coherent national cigarette smoking policy. This has since changed after the country joined WHO FCTC in 2005. A Royal anti-smoking decree was issued in 2015.[19] A new tax regime came into effect in mid-2017. Prior to 2017, the value of the most sold brand was 12.00 SAR (Saudi Arabian Riyal) (3.2 USD) of a 20-cigarette pack, of which only 16.67% of the price constituted import duties. The new policy in 2017 has pushed the price to 27.50 SAR (7.33 USD) of a 20-cigarette pack of the most sold brand. This was achieved through the introduction of ad valorem tax of 13.41 SAR (3.57 USD) (48.78%), a value-added tax of 1.30 SAR (0.34 USD) (4.76%), and import duties of 4.00 SAR (1.06 USD) (14.55%).[20] The current cigarette tax portion is 68.09%, which is within the yardstick of the World Bank.[18,21]

METHODS

The study was a retrospective econometric analysis of cigarette prices and consumption for the period from the beginning of January 2013 to the end of December 2019 using the methods of the World Bank Economics of Tobacco Toolkit.[22] To study the various factors besides pricing that might affect consumption of tobacco, we chose to limit the analysis to determination of Pearson correlation coefficients between these factors and per capita consumption because the available data from the General Authority for Statistics in Saudi Arabia is highly aggregated (country level estimates of tons of tobacco imported, average prices per pack of cigarettes, average income for all provinces, all provided per year). Our analysis focused on the price elasticity. The variables in the data included the annual per capita consumption of cigarettes, which we equated to the amount of cigarettes imported each year since there is no production or export of cigarettes from Saudi Arabia. Cigarettes containing tobacco (commodity code 24022000) were used in the calculation.[23] Because tobacco is perishable and cannot be stored for long periods, the importation figure is considered reliable in the calculation of consumption. We calculated per capita consumption through the division of total consumption by the size of the population aged 15-64 for each year. Besides price per pack, the other factors analyzed against per capita consumption were real individual income, education index, and the unemployment rate. The average annual price of a pack of 20 cigarettes was calculated

for the most popular selling brand, Marlboro.[24] The nominal price was divided by the consumer price index for a given year (100 for the base year 2013).[25] Income was calculated from wages minus wages times the inflation rate. The average real annual individual income was calculated using data from the Household Income and Expenditure National Survey and the annual reports issued by the Saudi Arabian Monetary Authority. The education index is published by the United Nations Human Development Report. The average unemployment rate was obtained from the Labor Force Survey. We calculated price elasticity to better understand how consumption behavior was affected by the price. According to the WHO and the World Bank, the most accurate method to study tobacco consumption is through estimation of the price elasticity of cigarette demand, which in simple terms is the change in cigarette demand resulting from a 1 percent increase in cigarette prices.[26] Price elasticity of demand is calculated as:

Price elasticity = percentage change in imports (I)/ percentage change in price (P).
I = imports and P= price.
The numerator is calculated as:
Percentage change in imports = (I2 − I1)/[(I2 + I1)/2]

The denominator is calculated as:
Percentage change in price = (P2 − P1)/[(P2 + P1)/2]

We chose the period from 2013 to 2019 to assess the effects of the major changes in governmental taxation on tobacco that was initiated in 2017. Statistical comparisons included correlation tests between price, income, educational index and unemployment with per capita consumption and a nonparametric linear regression (Kendall–Theil Sen Siegel method) of per capita consumption by year. Only cigarettes containing tobacco (commodity code 24022000) and Saudi population aged 15-64 years for the period of 2013-2019 were included. The analysis did not include E-cigarettes and other types of tobacco products.

RESULTS

From 2013 to 2019, importation of cigarettes containing tobacco into Saudi Arabia declined by nearly a third (27.41%), from 38 480 tons to 27 929. The per capita consumption declined accordingly while the price increased from 9.12 SAR (2.43 USD) to 25.1 SAR (6.69 USD) (**Figure 1**). From 2013 to 2016, the per capita consumption was similar from year to year, and then declined sharply in 2017 with the introduction of the new governmental taxation reform to reduce cigarette

consumption (**Table 1**). There was an ad valorem tax in 2017 and a value-added tax in 2018. The price of a pack of cigarettes increased by 115.1% from 11.65 SAR (3.10 USD) in 2016 to reach 25.06 SAR (6.68 USD) in 2018. The per capita consumption declined dramatically from 1830 to 943 cigarettes per year in 2018, then increased in 2019 to 1136 cigarettes per year.

While there was no correlation between the average annual price per pack and per capita consumption from 2013 to 2016 (*P*=.857), an inverse correlation was noted from 2016 to 2019 (*P*=.04, r=-0.957). The correlation for the whole time period was highly statistically significant (*P*=.0003285, r=-0.969). The inverse correlation between income and per capita consumption was also statistically significant (*P*=.025, r=-0.816) for the whole time period.

The education index did not correlate with per capita consumption (*P*=.740, r=-0.155), but unemployment was inversely and highly correlated (*P*=.008, r=-0.884) for the whole time period. A linear regression line fitted from 2015 onwards was statistically significant (*P*=.0156). The analysis indicates that per capita consumption is reduced by an average of 159 cigarettes per year. In 2016, even before the introduction of taxes that substantially increased the price of a pack of cigarettes, a 16.5% increase in price resulted in negative elasticity at that point, which is the goal of controlling the consumption of tobacco.

DISCUSSION

We found a strong inverse relationship between the annual price of a pack of cigarettes and the annual per
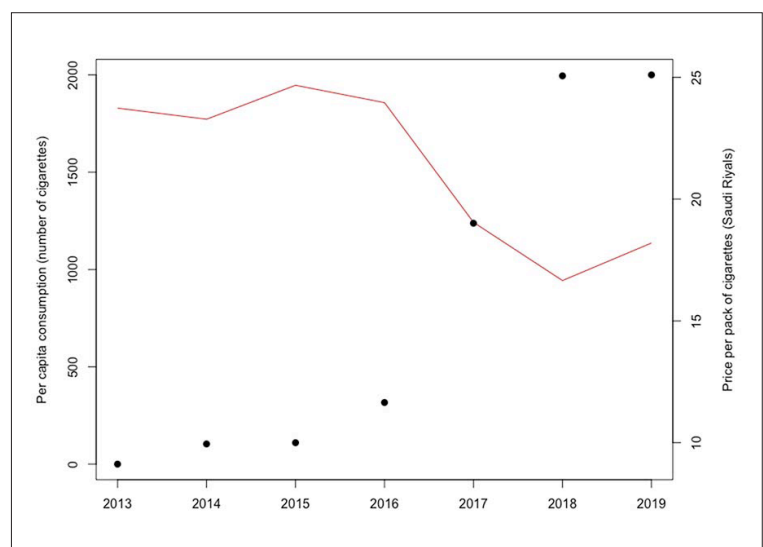

Figure 1. Price per pack of cigarettes (black dots) plotted with per capita consumption (red line) for each year of the study period.

capita consumption after the imposition of the reformed taxes in 2017. Our findings are consist with the findings of an important international advisory board of over 20 experts commissioned by the International Agency for Research on Cancer (IARC), a research agency of WHO, in 2011. They concluded that there was sufficient evidence to support increases in taxes to achieve a decline in overall and adult tobacco use, induce current users to quit, and reduce the prevalence of use among young people.[27,28] Our results are also consistent with a local study published in 2020[29,30] and other econometric studies performed in various countries which concluded that tax increases had a significant impact on smoking cessation, especially among heavy smokers, and effectively reduced cigarette use.[31,32] A 2014 systematic review of 77 reports, updated in 2020 with 68 additional studies, concluded that a tax-based strategy is, comparatively, one of the most effective measures to achieve the goal of reducing cigarette consumption.[33] Interestingly, our results showed a strong inverse correlation between the income and the annual per capita consumption. This is consistent with other local research,[7,29] but conflicts with conclusions of international studies.[18] A cross-sectional study using a quantitative research approach among 1015 male participants from 2018 to 2020 in Riyadh revealed no significant association between income and intention to quit.[34] This disparity in results requires more national research to explore the correlation between income and cigarette consumption in addition

to in-depth studies about the socioeconomic determinants of smoking in Saudi Arabia. We also found a strong inverse correlation between unemployment and tobacco use.[35] This finding is consistent with a cross-sectional study that was conducted in Jeddah after the introduction of a 100% ad valorem excise tax increase on cigarettes in June 2017.[29] Our result is consistent with studies published in 2020 and 2021 indicating that no association was observed between education and intention to quit smoking.[7,29,34]

Our estimates of price elasticity of demand corresponded with the changes in taxation policy that increased prices. The positive elasticity figures for the years from 2013 to 2015 were not in alignment with the goals of WHO and the World Bank to reduce consumption by increasing prices. Our estimates imply that smoking is a normal good. The price of cigarettes during these years remained low and affordable. In 2016, the average price of a pack of cigarettes reached 12 SAR (3.2 USD), a 16.5% increase from the previous year. At this point, the price elasticity of demand became negative at -0.07, which is equivalent to a decrease in demand of 1.15%. This was reflected by a decrease in cigarette imports by 1.1%. In 2016, consumption began to respond to the price increases in the year 2016.

The development of further negative elasticity became evident during 2017 and 2018 when consumption declined following the ad valorem excise tax imposed in June 2017. This trend was aligned with the WHO

Table 1. Estimated price elasticity of cigarette demand in Saudi Arabia (2013-2019).

Variable	2013[a]	2014	2015	2016	2017	2018	2019
Import (Ton)	38 480	38 693	43 931	43 449	29 415	22 773	27 929
Change in import (%)	3.3	0.5	13.53	-1.1	-32.3	-22.6	22.6
Average cigarette price (SAR)	9.12	9.95	10	11.65	19.01	25.06	25.1
Change in price (%)	8.6	9	0.5	16.5	63.17	31.82	0.16
Average real individual income (SAR)	26,193.96	27,529.56	28,795.22	29,950.00	32,027.60	32,069.70	34 449.37
Change in income (%)	3.8	5.1	4.6	4	7	0.13	7.4
Price elasticity of cigarette demand	0.4	0.06	25.29	-0.07	-0.8	-0.93	127.52
Prediction of reduction on consumption (%)	3.44	0.54	12.57	-1.15	-50.56	-28.71	20.6
Per capita consumption of tobacco cigarettes	1830	1772	1947	1877	1242	943	1136
Prediction of smoking prevalence rate (%)	1.72	0.27	6.3	-0.6	-25.3	-14.35	10.3

[a]2012, cigarette imports =37 221 ton, average cigarette price=8.4 SAR.

and the World Bank directives. For tobacco products, price elasticity should be negative, indicating that when price goes up, consumption goes down according to the WHO.[26] Specifically, during the period from 2017 to 2018, there was a decrease in importation by 22.6% with no significant increase in real individual income. Consequently, tobacco taxes reduced the affordability of cigarettes. Saudi consumers considered cigarettes as an inferior good. Conversely, the cigarette importation has increased by a percentage exactly equivalent to what was reduced in 2018 when the real individual income was increased by 7.4% in 2019. Elasticity shifted to positive purely due to the increase in income since the price per pack was relatively unchanged. This failure is due to lack of tax adjustment in a proactive manner in 2019. Thus, cigarettes became de facto more affordable for Saudi consumers. Cigarettes returned to the status of a normal good in 2019 after having the status of an inferior good in 2018. According to the World Bank, effective tax strategies involve combining big initial tax increases,[21] which was adopted by the Saudi government in addition to recurrent hikes over time, to keep cigarette prices climbing more steeply than per capita real income growth.[21] This was not implemented by the Saudi policy makers in 2019.

From 2013 to 2019, cigarette prices increased by 175.21% and consumption declined by 27.41%. Consumption could have declined by 70.084% based on an expected price elasticity of -0.4 that is typical of high-income countries.[21,28] However, the anticipated decline in consumption was offset by growth in real individual income in Saudi Arabia in 2019. To reduce that purchasing power, a greater increase in prices might be needed. We calculate that an additional 42.67% price increase from the price in 2019, when the price of a 20-cigarette pack was 25.1 SAR (6.69 USD), or pack price of SAR 35.81 (9.54 USD) might be enough to offset growth of real individual income in order to reduce the individual affordability to bear the costs of purchasing cigarettes (method of calculation, **Appendix 1**). In a cross-sectional study, respondents reported that a price of 31.01 SAR (8.27 USD) per pack would make them quit.[36] This would be 33.30 SAR (8.88 USD) in 2019. Our result is consistent also with other local recent research that revealed that tobacco taxation has a strong impact on the behavior of smokers. The current price of a packet of cigarettes, 25.1 SAR (6.69 USD) is considered low according to two evaluations conducted in Saudi Arabia in 2019 and 2020.[34,37] By comparison, the price per pack (in US$) was $12.37 in the United Kingdom , $9.39 in France, $9.15 in Canada in 2018,[20] and $6.86 in the United States (US) in 2013. The US is the fourth largest tobacco producing country in the world, according to the Centers for Disease Control in the US.[38]

In conclusion, we recommend additional changes to the tax policies that will encourage further decreases in consumption. Cigarettes should be subject to a higher excise tax. A specific excise tax on cigarettes (as opposed to ad valorem type of excise tax) is considered one of the most effective means of reducing consumption because it prevents consumers from converting to cheaper brands.[21] The taxes imposed in 2017 were less than those imposed in high-income countries. The WHO recommends that the excise tax be equivalent to 70% of the total price of the cigarette sale price.[18,37] In addition, growth in real individual income must be taken into account in order to minimize individual affordability to purchase cigarettes.[18] Regular pricing adjustments through specific excise levies will allow the government to create tailored anti-tobacco price and tax regimes that will improve the efficiency of national smoking curtailment practices. Policy changes should be evidence-based and data-driven. Finally, the tax system should include all products of tobacco, not only cigarettes, to prevent consumers from converting to other forms of smoked or smokeless tobacco. The limitations of this study are mainly the lack of more granular data on consumption and cigarette sales and more reliable data on prevalence.

REFERENCES

1. 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 [published correction appears in Lancet. 2017 Oct 7;390(10103):1644].Â Lancet. 2017;389(10082):1885-1906. doi:10.1016/S0140-6736(17)30819-X.

2. Britton J. Death, disease, and tobacco.Â Lancet. 2017;389(10082):1861-1862. doi:10.1016/S0140-6736(17)30867-X.

3. Tahir M. Smoking and its risks in Saudi Arabia: Literature review. Hamdan Medical Journal. 2018;12(4):152-7.Â doi: 10.4103/HMJ.HMJ_7_18.

4. World Health Organization. WHO global report on trends in prevalence of tobacco use 2000â€"2025, third edition. Geneva: World Health Organization; 2019:1-121.Â

5. Goodchild M, Nargis N, Tursan d'Espaignet E. Global economic cost of smoking-attributable diseases [published correction appears in Tob Control. 2018 Jul;27(4):478].Tob Control. 2018;27(1):58-64. doi:10.1136/tobaccocontrol-2016-053305.

6. Ekpu VU, Brown AK. The Economic Impact of Smoking and of Reducing Smoking Prevalence: Review of Evidence. Tob Use Insights. 2015;8:1-35. Published 2015 Jul 14. doi:10.4137/TUI.S15628.

7. Qattan AMN, Boachie MK, Immurana M, Al-Hanawi MK. Socioeconomic Determinants of Smoking in the Kingdom of Saudi Arabia. Int J Environ Res Public Health. 2021;18(11):5665. Published 2021 May 25. doi:10.3390/ijerph18115665.

8. Almutairi KM. Trends in Current Tobacco Use, Smoking Rates and Quit Attempts among Saudi Population during Periods of 17 Years (1996-2012): Narrative Review Article. Iran J Public Health. 2015;44(2):170-175.

9. Alotaibi SA, Alsuliman MA, Durgampudi PK. Smoking tobacco prevalence among college students in the Kingdom of Saudi Arabia: Systematic review and meta-analysis. Tob Induc Dis. 2019;17:35. Published 2019 Apr 19. doi:10.18332/tid/105843.

10. Salama R. Challenges facing smokers in Saudi Arabia. Int J Health Sci (Qassim). 2012;6(2):V-VI. doi:10.12816/0005986.

11. Al Moamary MS. Tobacco consummation: Is it still a dilemma? Ann Thorac Med. 2010;5(4):193-194. doi:10.4103/1817-1737.69103.

12. Ukuhor HO, Abdulwahab AA. Prevalence and workplace correlates of tobacco smoking among male expatriate workers in Riyadh, Saudi Arabia. East Mediterr Health J. 2019;24(12):1155-1164. Published 2019 Feb 18. doi:10.26719/emhj.18.005.

13. World Bank Open Data. Population, total - Saudi Arabia. Accessed 8 May 2021. https://data.worldbank.org/indicator/SP.POP.TOTL?end=2019&locations=SA&start=1960&view=chart

14. World Bank Open Data. Smoking Prevalence Tobacco Use in % of Adults. Accessed 8 May 2021. https://data.worldbank.org/indicator/SH.PRV.SMOK

15. Moradi-Lakeh M, El Bcheraoui C, Tuffaha M, Daoud F, Al Saeedi M, Basulaiman M, et al. Tobacco consumption in the Kingdom of Saudi Arabia, 2013: findings from a national survey. BMC public health. 2015 Dec;15(1):1-0.

16. World Health Organization. WHO report on the global tobacco epidemic, 2015: raising taxes on tobacco. World Health Organization. 2015. Accessed 8 May 2021. https://apps.who.int/iris/handle/10665/178574https://data.worldbank.org/indicator/SH.PRV.SMOK?locations=SA

17. Song Y, Zhao L, Palipudi KM, Asma S, Morton J, Talley B, et al. Tracking MPOWER in 14 countries: results from the Global Adult Tobacco Survey, 2008-2010. Global health promotion. 2016 Jun;23(2_suppl):24-37. doi:10.1177/1757975913501911 World Health Organization. WHO report on the global tobacco epidemic, 2015: raising taxes on tobacco. Luxembourg: World Health Organization. Accessed 8 May 2021. https://apps.who.int/iris/handle/10665/178574

18. Marquez PV, Moreno-Dodson B. Tobacco Tax Reform at the Crossroads of Health and Development: A Multisectoral Perspective. World Bank, Washington, DC. World Bank. 2017. 1-222.

19. Itumalla R, Aldhmadi B. Combating tobacco use in Saudi Arabia: a review of recent initiatives. East Mediterr Health J. 2020;26(7):858-863. Published 2020 Jul 23. doi:10.26719/emhj.20.019.

20. World Health Organization. 9.1 Taxes and retail price for a pack of 20 cigarettes most sold brand. Web Annex VI: Global Tobacco Control Policy Data. 3 August 2021. Accessed 8 May 2021. https://www.who.int/publications/i/item/WHO-HEP-HPR-TFI-2021.9.1

21. The World Bank. Curbing the epidemic: governments and the economics of tobacco control. Tobacco Control 1999;8:196-201. doi: doi.org/10.1136/tc.8.2.196.

22. Wilkins N, Yurekli A, Hu T. Economics of Tobacco Toolkit, Tool 3: Economic Analysis of Tobacco Demand. World Bank, Washington, DC. World Bank 2013. Accessed 8 May 2021. https://openknowledge.worldbank.org/handle/10986/16269

23. General Authority for Statistics. Imports Statistics 2019. Accessed 8 May 2021. https://www.stats.gov.sa/sites/default/files/Imports%202019.pdf

24. General Authority for Statistics. Average Prices of Goods and Services 2009-2019. Accessed 8 May 2021. https://www.stats.gov.sa/en/160

25. General Authority for Statistics. Consumer Price Index - 2019. Accessed 8 May 2021. https://www.stats.gov.sa/en/394

26. World Health Organization. Estimating price and income elasticity of demand. Accessed 8 May 2021. https://apps.who.int/gb/fctc/PDF/cop4/FCTC_COP4_11-en.pdf

27. Chaloupka FJ, Straif K, Leon ME; Working Group, International Agency for Research on Cancer. Effectiveness of tax and price policies in tobacco control. Tob Control. 2011;20(3):235-238. doi:10.1136/tc.2010.039982.

28. U.S. National Cancer Institute and World Health Organization.Â The Economics of Tobacco and Tobacco Control. National Cancer Institute Tobacco Control Monograph 21. NIH Publication No. 16-CA-8029A. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute; and Geneva, CH: World Health Organization; 2016. Accessed 8 May 2021. https://cancercontrol.cancer.gov/sites/default/files/2020-08/m21_complete.pdf

29. Alghamdi A, Fallatah A, Okal F, Felemban T, Eldigire M, Almodaimegh H. Smoking behaviour after enforcement of a 100% tax on tobacco products in Saudi Arabia: a cross-sectional study. East Mediterr Health J. 2020;26(1):39-46. Published 2020 Jan 30. doi:10.26719/2020.26.1.39.

30. Al-Tannir M, Abu-Shaheen A, Altannir Y, Altannir M. Tobacco price increase and consumption behaviour among male smokers in Saudi Arabia: a community-based study. East Mediterr Health J. 2020;26(12):1518-1524. Published 2020 Dec 9. doi:10.26719/emhj.20.066.

31. Tabuchi T, Nakamura M, Nakayama T, Miyashiro I, Mori J, Tsukuma H. Tobacco Price Increase and Smoking Cessation in Japan, a Developed Country With Affordable Tobacco: A National Population-Based Observational Study. J Epidemiol. 2016;26(1):14-21. doi:10.2188/jea.JE20140183.

32. Guindon GE, Paraje GR, Chaloupka FJ. The impact of prices and taxes on the use of tobacco products in Latin America and the Caribbean. Am J Public Health. 2015;105(3):e9-e19. doi:10.2105/AJPH.2014.302396.

33. Hill S, Amos A, Clifford D, Platt S. Impact of tobacco control interventions on socioeconomic inequalities in smoking: review of the evidence. Tob Control. 2014;23(e2):e89-e97. doi:10.1136/tobaccocontrol-2013-051102

34. Aljuaid SO, Alshammari SA, Almarshad FA, Almutairi KS, Aljumayi AS, AlKhashan HI, et al. Taxation and tobacco plain packaging effect on Saudi smokers quitting intentions in Riyadh city, Saudi Arabia. Saudi Medical Journal. 2020;41(10):1121.

35. Henkel D. Unemployment and substance use: a review of the literature (1990-2010). Curr Drug Abuse Rev. 2011;4(1):4-27. doi:10.2174/1874473711104010004.

36. Al-Mohrej OA, AlTraif SI, Tamim HM, Fakhoury H. Will any future increase in cigarette price reduce smoking in Saudi Arabia?. Ann Thorac Med. 2014;9(3):154-157. doi:10.4103/1817-1737.134070

37. Alqarni AM. Saudi Smokers' Behaviors After a 100% Tax Increase. International Journal of Marketing Studies 2019; 11(1): 150-159. doi: 10.5539/ijms.v11n1p150.38. Centers for Disease Control and Prevention. Economic Trends in Tobacco. Accessed 8 May 2021. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/economics/econ_facts/index.htm

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APPENDIX 1

The World Bank in a review[1-3] concluded that, impact of price increases on aggregate demand in high income countries on average price elasticity of about–0.4. In other words, an increase in price of 10% leads to a 4% reduction in consumption in high income countries.

In Saudi Arabia, the price increased by 175.21%

10% reduces consumption by 4%

175.21% reduces consumption by 70.084%

To calculate the reduction in consumption: (175.21%x4%)/10%=70.084% reduction in consumption.

However, this did not happen. The observed reduction was 27.41%. The difference between the actual and expected is 70.084%-27.41%=42.67%

To calculate 42.67% in Saudi Riyals:
25.1X42.67%=10.71 SAR.

Add 10.71 SAR (2.85 USD) to the current price 25.1 SAR (6.69 UDS) to reach 70.084% in consumption reduction:
Then the suggested price should be 25.1+10.71=35.81 SAR (9.54 USD).

References:
1. Marquez PV, Moreno-Dodson B, Bank TW. Tobacco Tax Reform at the Crossroads of Health and Development : A Multisectoral Perspective. 2017.
2. NCI NCI. TOBACCO CONTROL MONOGRAPH SERIES. 2016.
3. Jha P. Avoidable global cancer deaths and total deaths from smoking. Nature Reviews Cancer. 2009;9(9):655-64. doi: 10.1038/nrc2703.