Meeting the Global Health Challenge to Reduce Death and Disability from Alcohol, Tobacco, and Sugar-Sweetened Beverage Consumption with Corrective Taxes

Chris Lane and Vinayak Bhardwaj

Abstract

Behind the daily trauma of COVID-19 lies a larger and longer-lasting global health challenge resulting from the consumption of tobacco, alcohol, and sugar-sweetened beverages. Using a sample of 25 large advanced and emerging market economies accounting for three-quarters of global GDP, we show that about 60 million productive life years were lost every year in 2000, 2010, and 2019 from death and disability attributable to alcohol, tobacco, and diets high in sugar-sweetened beverages. Using the cost-of-illness framework, the economic value of these lost productive years in 2019 is approximately $ 2.1 trillion in our country sample (in 2017 purchasing power parity dollars [PPP$]). We show that over a 20-year period, a higher tax effort is associated with larger reductions in economic costs. We also show that total corrective taxes for all the products under investigation fall far short of the indirect costs of consumption in all countries. We conclude that all advanced economies and emerging markets could reap substantial macroeconomic benefits from better health by raising corrective taxes on alcohol and tobacco, and by introducing corrective taxes on sugar-sweetened beverages.

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Summary

Behind the daily trauma of COVID-19 lies a larger and longer-lasting global health challenge resulting from the consumption of tobacco, alcohol, and sugar-sweetened beverages (SSBs). Every year, consumption of these products results in 12.5 million premature deaths and over 50 million years lived with disability from new cases. This paper analyzes the economic costs of death and disability attributable to the consumption of these products over the period 2000–2019 in 25 large advanced and emerging market economies accounting for three-quarters of global GDP and compares the costs with corrective taxes collected to curb these products' consumption. Our study builds on other studies that have tended to look at the global productivity costs and taxes relating to each product separately or all products in a single country rather than in the cross-country unified approach used in this paper.

Every year in our country sample, about 60 million productive life years (i.e., affecting workers in the cohort of 20–65 years of age) are lost through death and disability attributable to alcohol, tobacco, and diets high in SSBs. Productive life years lost decreased slightly in advanced economies in the 2000–2019 period but increased in emerging markets. We assign an economic cost to these lost productive years using the cost-of-illness framework. The value of these lost productive years in 2019 is approximately $2.1 trillion in our country sample (in 2017 purchasing power parity dollars [PPP$]). We show that total indirect costs as a share of GDP fell in most economies during the 2000–2019 period, in some cases significantly, although costs continued to rise in Saudi Arabia, Ukraine, and Vietnam, and there has been no significant change in cost trends in China, India, Indonesia, and the Philippines. Overall, the economic burden of death and disability from alcohol, tobacco, and SSBs is felt predominantly in emerging markets, reflecting their larger populations.

There are also important differences in trends across products, with more marked declines in costs attributable to tobacco than to alcohol, and striking increases in costs attributable to SSBs, albeit from a low base. Care is needed in interpreting changes in indirect costs over time, as the drivers include not only the incidence of death and disability but changes in the prevalence of consumption over time, as well as changes in labor force participation.

We highlight the important role corrective taxes (excise taxes) have played in reducing consumption of tobacco and saving productive lives in advanced economies—and the largely unrealized potential for similar gains in many emerging markets. Over a 20-year period, a higher tax effort is associated with larger reductions in economic costs. We also show that total corrective taxes for all the products under investigation fall far short of the indirect costs of consumption in all countries. On average, corrective taxes are equivalent to slightly over one-third of the productivity loss from death and disability (taxes are on average 1.4 percent of GDP less than productivity losses), before taking account of public medical treatment costs and other externalities such as accidents and antisocial behavior, providing a strong rationale to further raise corrective taxes.

We show that progress in reducing alcohol-attributable death and disability through corrective taxes has been limited in both advanced and emerging markets. In the context of rapidly rising levels of obesity and diabetes related in part to increasing consumption

of SSBs, several countries have introduced corrective taxes on added sugars. We conclude that all advanced economies and emerging markets could reap substantial macroeconomic benefits from better health by raising corrective taxes on alcohol and tobacco and by introducing corrective taxes on SSBs.

The paper is organized as follows. Section 1 outlines the rationale for corrective taxes to address "internalities" (i.e., self-imposed costs resulting in death or disability). Section 2 summarizes the methods used to calculate the productivity loss arising from premature death and disability attributable to alcohol, tobacco, and SSB consumption and highlights the sources of data and metrics for corrective taxes. Section 3 summarizes the results for indirect costs across all three risk factors (products) and compares these costs to total corrective taxes collected. Section 4 considers costs and corrective taxes for each risk factor in turn. Section 5 concludes. Appendix 1 provides details of the productivity loss calculations, and Appendix 2 benchmarks our tobacco productivity estimations against the existing literature.

1. Rationale for corrective taxes

The traditional approach to setting corrective taxes focuses on externalities arising from consumption, such as secondhand smoke and accidental fires (tobacco); car accidents and crime (alcohol); airborne pollution (hydrocarbon fuels); and health costs not borne by the consumer, such as higher insurance premiums and higher public spending on health financed from general taxation, as well as the loss of tax revenue from premature death (harmful products in general). Taxes on producers or consumers for external costs to induce them to lower consumption to the socially optimal level are known as Pigouvian taxes (Pigou 1920). Taxes on a product should be set equal to the net cost of externalities of product use for the marginal product consumed.

The public health approach to setting corrective taxes aims to maximally discourage consumption of health-harming products to address both externalities and internalities (self-imposed costs such as premature death or disability) (Cnossen 2010). Under the traditional approach, no corrective taxes are needed for internalities as these are assumed to be considered by the consumer at the time of purchase. However, two motivations support the use of corrective taxes to tackle internalities:

(1) Consumers discount short-run decisions more than long-term decisions so that they over-consume products that have long-term adverse health impacts, (i.e., they have time-inconsistent behavior that underweights the future consequences of present consumption) (Gruber and Koszegi 2008, for tobacco and Allcott et al. 2019 for SSBs) and that corrective taxation to address this time inconsistency improves welfare (Gruber and Mullainathan 2002);
(2) Informational failures that result in excessive consumption due to imperfect health and nutrition knowledge, such as underestimating the extent of addiction (Gruber and Koszegi 2008).

Our focus in this paper are the internalities from premature death and disability, while making some reference to other externalities to the extent that country-level data is available.

2. Methods

We focus on advanced and emerging economies that have high or rising rates of death and disability from noncommunicable diseases compared to low-income economies. Due to limited data availability, especially for corrective tax revenues, we focus on 25 large economies accounting for 76 percent of global GDP at PPP in 2019, comprising the countries in the G-20 (excluding the European Union as an entity but including France, Germany, Italy, and the United Kingdom as country members of the G-20) plus 6 other large middle-income emerging markets (Bangladesh, Nigeria, Pakistan, the Philippines, Ukraine, and Vietnam) not represented in the G-20.

We calculate the mortality and disability attributed to three preventable risk factors—the consumption of alcohol, tobacco, and high quantities of SSBs—in 2000, 2010, and 2019 using the Institute for Health Metrics and Evaluation Global Burden of Disease database.[1]

Using the cost-of-illness approach,[2] we demonstrate the economic cost of lost productivity from premature death and disability attributable to these products (Box 1).

Box 1. How to calculate the cost of illness

The cost-of-illness approach estimates direct and indirect costs of illness. The direct cost is estimated from costs of treatment of illnesses attributable to alcohol, tobacco, and SSBs. The indirect cost of illness is the economic value of lost production attributable to (1) years of life lost (for each risk factor) resulting from deaths in the working-age population in the labor force, for males and females, and (2) the years lived with disability from new incident cases attributable to each risk factor (this figure is calculated as the number of new incident cases multiplied by the disability weight and the average duration of the case until remission or death). The details of the cost-of-illness approach are presented in Appendix 1.

While it would be conceptually desirable to include the costs of medical treatment arising from alcohol-, tobacco-, and SSB-attributable illnesses, they are beyond the scope of this study. This is primarily due to the lack of available data on the cost of treatment for illnesses attributable to each of the three products across 25 countries for 2000–2019. An additional complication is the challenge of assessing who bears the costs (the patient, taxpayers, or other parties through public or private insurance). The available data and relevant literature are also discussed in Section 3.

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[1] Data on mortality and disability are available from the Institute of Health Metrics and Evaluation Global Health Data Exchange at http://ghdx.healthdata.org/gbd-2019. A summary of findings on risk factors is discussed in *GBD 2019 Risk Factors Collaborators, "Global Burden of 87 Risk Factors in 204 Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019, The Lancet* 396, no. 10258 (October 17, 2020): 1223–1249, https://doi.org/10.1016/S0140-6736(20)30752-2.

[2] See: WHO, *Economics of Tobacco Toolkit: Assessment of the Economic Costs of Smoking* (Geneva: WHO, 2011), https://apps.who.int/iris/handle/10665/44596.

Placing corrective taxes on tobacco and alcoholic and sugar-sweetened beverages reduces consumption, saves lives over the medium to long term, and reduces other economic and social costs of consumption. Higher taxes that lead to higher prices for health-harming products save more lives: a 50 percent increase in tobacco, alcohol, and SSB prices due to higher corrective taxes would save an estimated 50 million lives over the long term.[3] An additional significant advantage of corrective taxes is that they are a tried and tested revenue source for countries in a fiscal fix, as tax rates are generally easy to adjust, generate revenue quickly and reliably, and typically do not require new administrative arrangements,[4] although vested interests may make it challenging to implement meaningful change. However, given that incentives for fraud are broadly related to the size of the tax wedge, increasing taxes should go hand in hand with tighter administrative controls.[5]

Drawing on multiple data sources, we examine corrective taxes applied to alcohol, tobacco, and SSBs, expressed as a share of GDP to enable a comparison of taxation across products and across countries. Corrective taxes, usually labeled as excise taxes, are defined as taxes that are levied on a specific product in addition to general consumption taxes. Their purpose is to change behavior, either to discourage the bad or encourage the good.[6] Data are sourced from the World Health Organization (WHO) Global Health Observatory for all countries, from the OECD for some advanced economies, and from the health taxes literature to fill remaining data gaps. Corrective tax metrics other than tax-to-GDP ratio are available for tobacco, especially cigarettes (such as excise tax as a share of retail price for the most sold brand), but these are not widely available for alcoholic drinks and do not take account of tax avoidance and evasion—hence the focus on taxes collected as a share of GDP. For alcohol and tobacco, measures of tax effort are constructed that adjust the tax-to-GDP ratio based on tobacco prevalence and alcohol consumption per capita.

We show that over a 20-year period, a higher tax effort is associated with larger reductions in economic costs. We also show that total corrective taxes for all products fall short of the indirect costs of consumption in all countries, on average by 1.4 percent of GDP (before taking account of public medical treatment costs and other externalities such as accidents and antisocial behavior), providing a strong rationale to further raise corrective taxes.

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[3] See: Task Force on Fiscal Policy for Health, *Health Taxes to Save Lives: Employing Effective Excise Taxes on Tobacco, Alcohol, and Sugary Beverages* (New York: Bloomberg Philanthropies, 2019), https://www.bloomberg.org/press/task-force-fiscal-policy-health-calls-increase-excise-taxes-tobacco-alcohol-sugary-beverages/; and Chris Lane, Amanda Glassman, and Eleni Smitham, *Using Health Taxes to Support Revenue: An Action Agenda for the IMF and World Bank*, CGD Policy Paper 203 (Washington, DC: Center for Global Development, 2021), https://www.cgdev.org/publication/using-health-taxes-support-revenue-action-agenda-imf-and-world-bank.

[4] Jamie F. Chriqui, Frank J. Chaloupka, Lisa M. Powell, and Shelby S. Eidsond, *A Typology of Beverage Taxation: Multiple Approaches for Obesity Prevention and Obesity Prevention-Related Revenue Generation*, Journal of Public Health Policy 34, no. 3 (May 23, 2013): 403–423, https://doi.org/10.1057/jphp.2013.17.

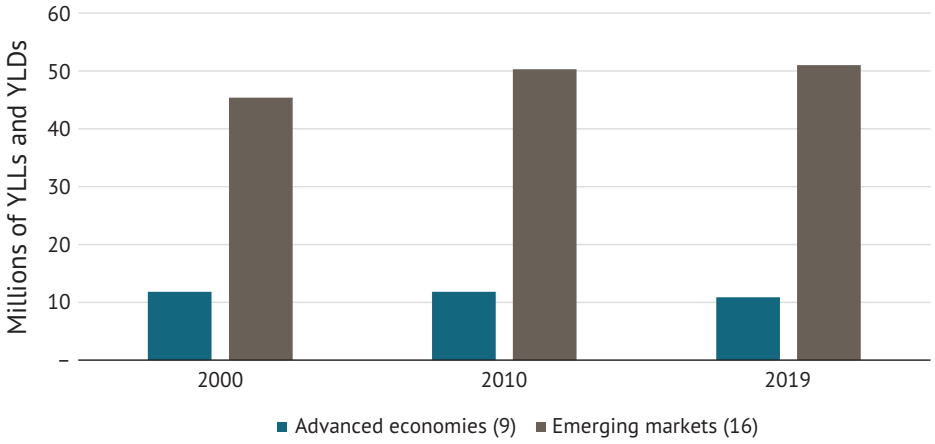
[5] See, for example: Patrick Petit and Janos Nagy, *How to Design and Enforce Tobacco Excises* (Washington, DC: International Monetary Fund, 2016), https://www.imf.org/external/pubs/ft/howtonotes/2016/howtonote1603.pdf.

[6] See Chapter 8, M Keen and J Slemrod, 2021, *Rebellion, Rascals, and Revenue*. Princeton University Press.

3. Costs of alcohol, tobacco, and SSB consumption and corrective taxes

Mortality attributable to tobacco, alcohol, and diets high in SSBs remains high: in our 25-country sample in 2019, 5.1 million people of all ages died of tobacco-attributable diseases, 1.2 million from alcohol-attributable diseases, and 0.1 million from diseases attributable to diets high in SSBs. That same year saw a total of 26 million years lived with disability from all three risk factors. The total annual economic cost of disease attributable to alcohol, tobacco, and diets high in SSBs comprises the number of productive years of life lost from premature death in that year and the years lived with disability (for new incident cases expressed as disability-adjusted life years). As illustrated in Figure 1, about 60 million productive life years were lost each year in 2000, 2010, and 2019 in our sample of advanced economies and emerging markets (and roughly 80 million productive life years globally). Productive life years lost decreased slightly in advanced economies but continued to rise in emerging markets between 2000 and 2019. The value of these lost life years in 2019 is approximately PPP$1.14 trillion in our country sample and PPP$1.47 trillion worldwide (using 2019 global PPP GDP per capita of PPP$18,381). Also, the burden of death and disability attributable to alcohol, tobacco, and SSBs is predominantly felt in emerging markets, reflecting their larger populations.

Figure 1. Total years of life lost (YLLs) and years lived with disability (YLDs) attributable to alcohol, tobacco, and SSBs for 25 large economies, 2000–2019



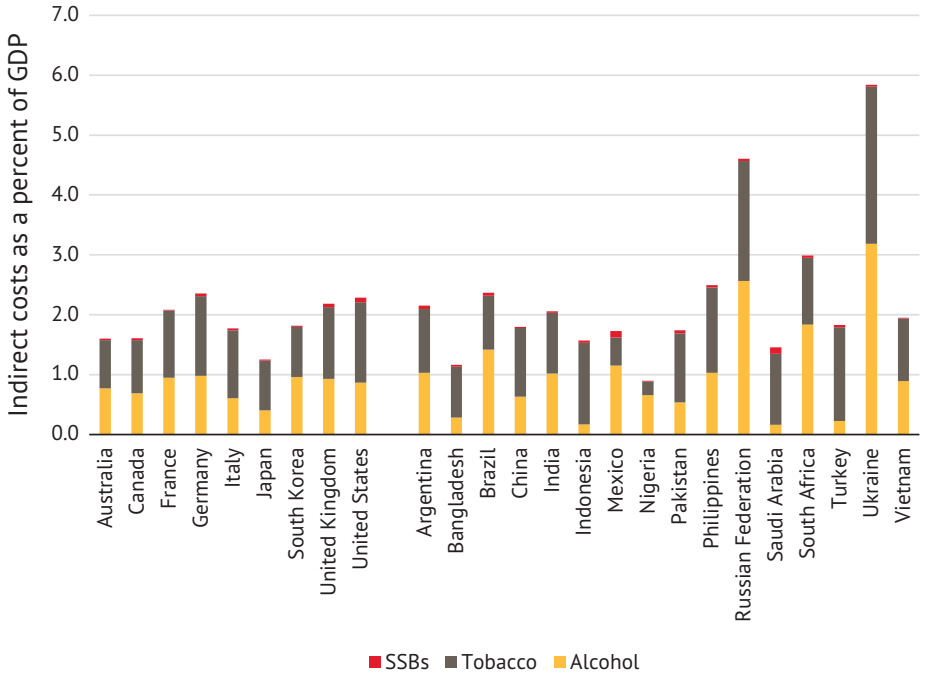
Note: Countries: Argentina, Australia, Bangladesh, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Nigeria, Pakistan, Philippines, Russian Federation, Saudi Arabia, South Africa, South Korea, Turkey, Ukraine, United Kingdom, United States, and Vietnam.
Source: IHME GBD (Institute for Health Metrics and Evaluation, Global Burden of Disease Study, 2019. http://ghdx.healthdata.org/gbd-2019).

The value of productivity loss attributable to productive life years lost through death and disability is expressed as a share of 2017 PPP$ GDP. We do not inflate the value of future life years' income lost with projected GDP per capita growth or use a discount rate for future income, as the selection of both variables is essentially arbitrary, and taken together these

variables largely cancel each other out (e.g., growth rates of 2–5 percent per year and typical discount rates of 3–5 percent per year).

Tobacco consumption is the largest single determinant of death and disability, leading to productivity losses averaging 1.15 percent of GDP in 2019 (unweighted average across the country sample), followed by alcohol (0.96 percent of GDP), although this varies more across countries than tobacco costs; diets high in SSBs account for a relatively small share of the total disease burden (0.04 percent of GDP) (Figure 2a). Current death and disability figures reflect the prevalence of current and past consumption of these products as well as current and past control measures, including corrective taxes. The age distribution of death and disability also affects costs—with costs being relatively higher for death and disability that affect young productive workers, as more productive life years are lost.

Figure 2a. Productivity loss from death and disability attributable to alcohol, tobacco, and SSBs by product, 2019, for 25 large economies (as a percentage of GDP)

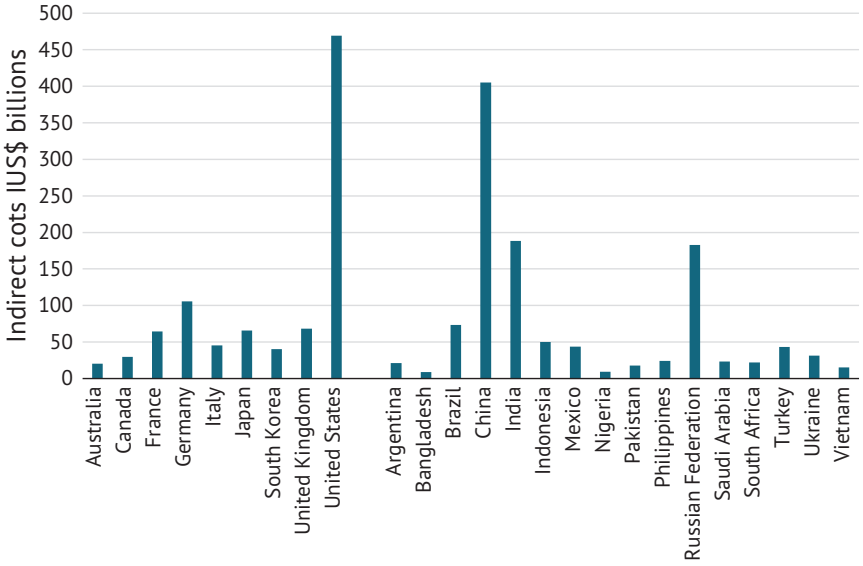


Sources: IHME GBD 2019; World Bank World Development Indicators https://databank.worldbank.org/source/world-development-indicators; WHO life tables https://www.who.int/data/gho/data/themes/topics/indicator-groups/indicator-group-details/GHO/gho-ghe-global-health-estimates-life-tables.

To better comprehend the magnitude of these productivity losses arising from death and disability due to alcohol, tobacco, and SSB consumption, we express them in international or PPP dollars, that is, to equalize the purchasing power of different currencies by eliminating the price differences between countries. The total productivity loss in 2019 is slightly more

than PPP$2 trillion (expressed in 2017 prices), of which PPP$0.9 trillion is in our large advanced country sample and PPP$1.1 trillion in our large developing country sample. Sixty percent of these losses are borne by four countries: the United States, China, Russia, and India. Figure 2b shows the dollar costs by country.

Figure 2b. Productivity loss from death and disability attributable to alcohol, tobacco, and SSBs, 2019, for 25 large economies (2017 PPP$ billions)

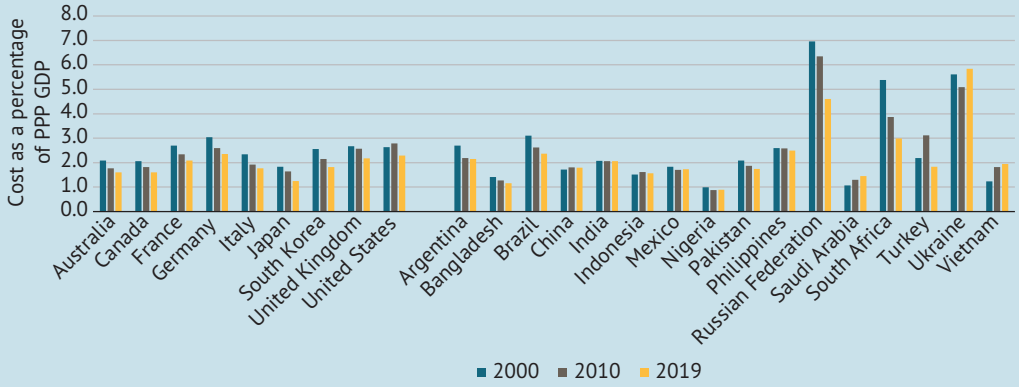


Sources: See Figure 2a.

Annual economic costs resulting from death and disability declined gradually in most countries over the 2000–2019 period as a percentage of GDP but remained high in absolute terms. Total costs fell in all advanced economies during 2000–2019, to just under 2 percent of GDP on average, and also fell on average in emerging markets, to 2.3 percent GDP (Box 2 provides more details).

Box 2. Trends of productivity losses due to death and disability

Box Figure 1. Productivity losses from death and disability attributable to alcohol tobacco and SSBs, percentage of PPP GDP, 200–2019

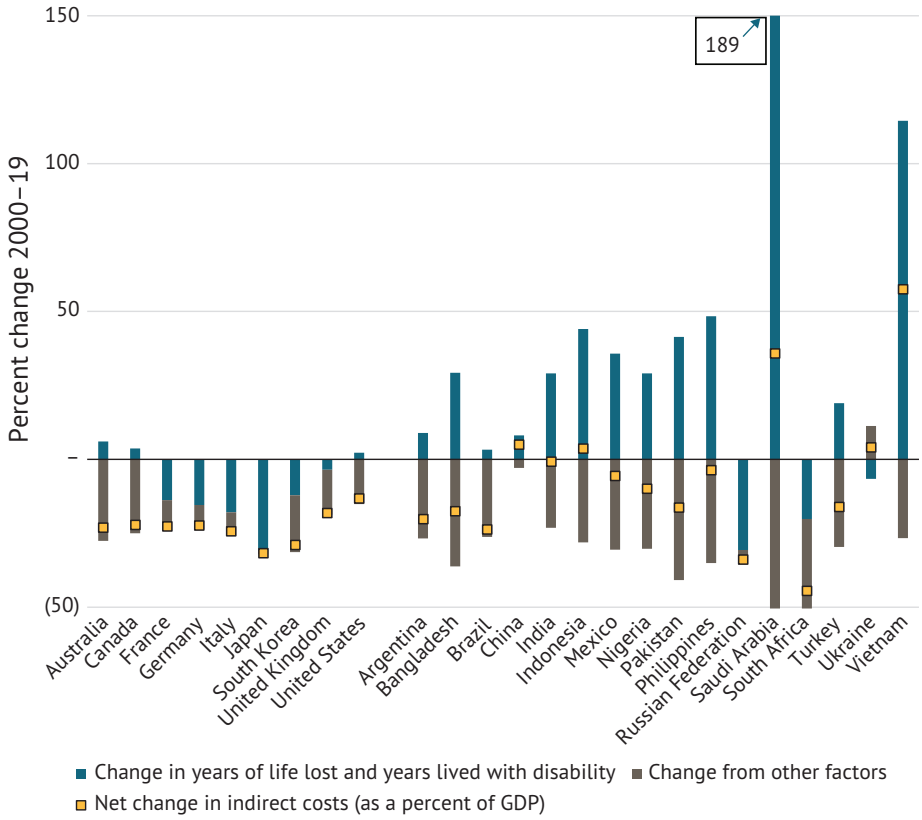


Sources: See Figure 2a.

Productivity losses as a percentage of GDP declined between 2000 and 2019 in advanced and emerging economies, but at a slower rate in emerging economies because costs continued to rise in Saudi Arabia, Ukraine, and Vietnam, and there has been no significant change in costs in China, India, Indonesia, Mexico, Nigeria, and the Philippines since 2000. Costs in a few emerging markets remain very high, ranging between 4 and 7 percent of GDP in Russia, South Africa, and Ukraine over the last 20 years.

The drivers of indirect costs of death and disability differ significantly across advanced and emerging markets (Figure 3). In advanced economies, the number of life years lost through death and disability declined or increased only marginally between 2000 and 2019, whereas in emerging markets the burden of disease increased substantially in most economies except in Russia, South Africa, and Ukraine, where the figures declined from very elevated levels at the start of the period. Expansion of the labor force as a result of increased population and/or increased labor force participation provides an offsetting factor in all countries except Ukraine and Japan. To illustrate this factor, in many countries there has been an increase in female labor force participation and, because death and disability from alcohol and tobacco consumption are significantly lower for women than men, this reduces the overall cost of death and disability as a share of GDP.

Figure 3. Drivers of changes in indirect costs of alcohol-, tobacco-, and SSB-attributable mortality and disability, 2000–2019



Sources: See Figure 2a.

3.1. Direct economic costs

In assessing the economic costs of death and disability, we should take into account other costs of consumption that are borne by others, notably medical costs, particularly those not directly borne by the consumer. We discuss these further in the context of each product below.

3.2. Corrective taxes to reduce consumption, death, and disability

It is widely recognized that raising corrective taxes (excises) is a highly effective way to reduce or deter harmful consumption of alcohol, tobacco, and SSBs, including as "best buys" for the prevention and control of noncommunicable diseases:[7]

[7] WHO, '*Best Buys' and Other Recommended Interventions for the Prevention and Control of Noncommunicable Diseases* (Geneva: WHO, 2017), https://www.who.int/ncds/management/WHO_Appendix_BestBuys_LS.pdf.

- The WHO SAFER initiative recommends raising prices on alcohol through excise taxes and pricing policies;[8] a review of 50 studies that examined the impact of taxes and prices on various harms caused by alcohol concluded that a 10 percent increase in alcohol taxes was associated with a 3.5 percent decline in all harms associated with alcohol-related diseases and injuries, including car crashes, homicide, rape, robbery, child abuse, and workplace injuries (Wagenaar, Salois, and Komro 2009).
- A substantial body of research over many decades and many countries shows that significantly increasing the excise tax and price of tobacco products is the single most consistently effective tool for reducing tobacco use,[9] and Article 6 of the WHO Framework Convention on Tobacco Control encourages tax measures to reduce demand for tobacco, including tax increases that result in an increase in the sales price of tobacco products and prohibiting or restricting sales of tax- and duty-free tobacco products.[10]
- WHO recommends reducing the intake of free sugars to less than 10 percent of total energy intake (12 teaspoons of sugar per day, compared to 10 teaspoons of sugar in a single sugary drink can)[11] and states that taxation of SSBs is an effective intervention to reduce sugar consumption.[12] Numerous studies around the world show that SSB taxes have been effective in reducing SSB purchases and dietary intake of free sugars.[13]

The 2019 Task Force on Fiscal Policy for Health simulated tax increases that raised tobacco and alcoholic and sugar-sweetened beverage prices by up to 50 percent. These result in a change in annual tax revenues of up to 0.7 percent of GDP in upper-middle-income countries, 1 percent in low-income countries, and 1.2 percent in lower-middle-income countries (Lane, Glassman, and Smitham 2021). Fifty million premature deaths could be averted worldwide over the next 50 years while raising over US$20 trillion

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[8] See: WHO, "WHO Launches SAFER Alcohol Control Initiative to Prevent and Reduce Alcohol-Related Death and Disability" (news release), September 28, 2018, https://www.who.int/news/item/28-09-2018-who-launches-safer-alcohol-control-initiative-to-prevent-and-reduce-alcohol-related-death-and-disability.

[9] See p. 151 of U.S. National Cancer Institute and WHO, *The Economics of Tobacco and Tobacco Control*, National Cancer Institute Tobacco Control Monograph 21, NIH Publication No. 16-CA-8029A (Bethesda, MD: National Cancer Institute, 2016), https://cancercontrol.cancer.gov/brp/tcrb/monographs/monograph-21.

[10] See: WHO Framework Convention on Tobacco Control Secretariat, *WHO Framework Convention on Tobacco Control: An Overview*, March 5, 2021, https://fctc.who.int/publications/m/item/the-who-framework-convention-on-tobacco-control-an-overview.

[11] See: WHO, *Guideline: Sugars Intake for Adults and Children* (Geneva, WHO, 2015), https://www.who.int/publications/i/item/9789241549028.

[12] See: WHO, *Taxes on Sugary Drinks: Why Do It?* 2017, https://apps.who.int/iris/bitstream/handle/10665/260253/WHO-NMH-PND-16.5Rev.1-eng.pdf?sequence=1.

[13] See: Maria A. Cabrera Escobar, J. Lennert Veerman, Stephen M. Tollman, Melanie Y. Bertram, and Karen J. Hofman, *Evidence That a Tax on Sugar Sweetened Beverages Reduces the Obesity Rate: A Meta-analysis*, *BMC Public Health* 13 (November 13, 2013): 1072, https://doi.org/10.1186/1471-2458-13-1072; and Andrea M. Teng, Amanda C. Jones, Anja Mizdrak, Louise Signal, Murat Genç, and Nick Wilson, *Impact of Sugar-Sweetened Beverage Taxes on Purchases and Dietary Intake: Systematic Review and Meta-analysis*, Obesity Reviews 20, no. 9 (September 2019): 1187–1204, https://doi.org/10.1111/obr.12868.

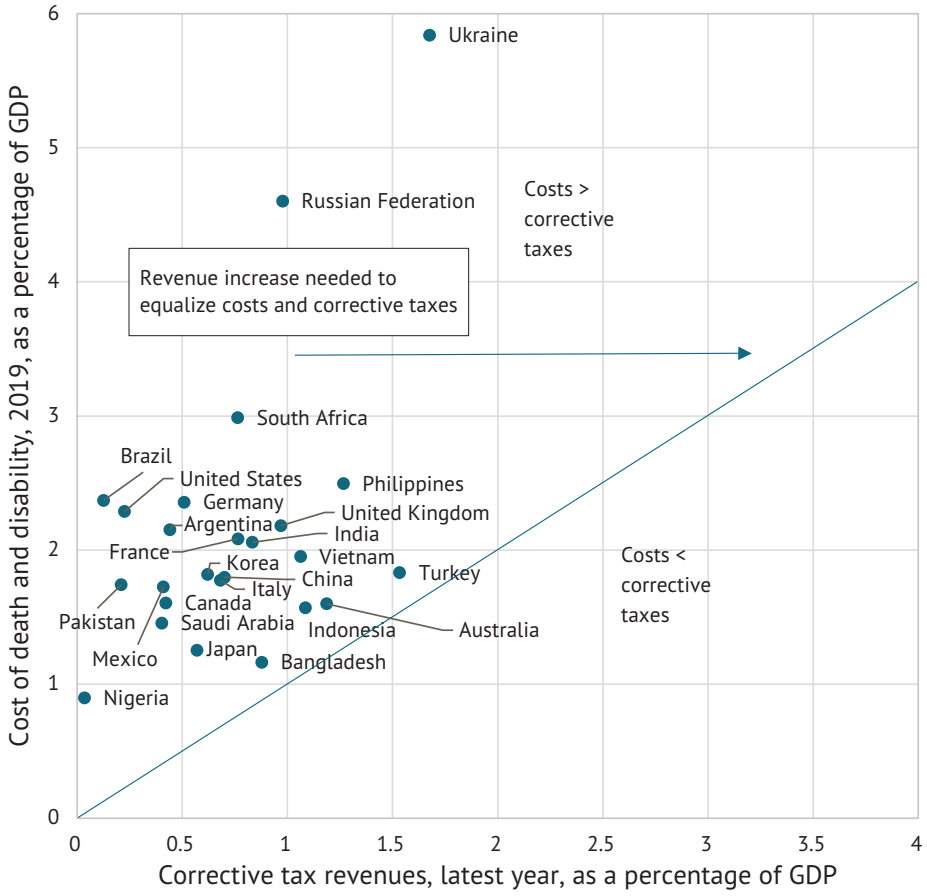
(present discounted value) in additional revenues (Task Force on Fiscal Policy for Health 2019).

In our 25-country sample, all countries levy corrective taxes on tobacco and on alcoholic drinks (in Saudi Arabia and Pakistan, consumption is largely prohibited), and seven countries tax SSBs (France, India, the Philippines, Saudi Arabia, South Africa, the United Kingdom, and the United States in some jurisdictions). However, the taxes collected remain significantly lower than the economic costs of death and disability resulting from the use of these products.

Looking at all three harmful products together, we find that corrective taxes collected (according to the most recent available data) fall significantly short of the 2019 economic costs of mortality and disability in all 25 countries in our sample (Figure 4). On average, corrective taxes are equivalent to slightly more than one-third of the cost of mortality and disability. Closing this gap would require corrective tax increases of 1.4 percent of GDP on average, and significantly more in the countries with the largest gaps between cost and corrective taxes (Ukraine, Russia, Brazil, and South Africa). Adding in other externalities of consumption (public medical costs, criminal damage, and antisocial behavior) would further increase this gap between corrective taxes and economic costs.

If countries were able to raise corrective taxes to equal or exceed the costs of death and disability, this would increase the rate at which consumption was reduced and, over time, reduce death and disability. There would, however, be no presumption that corrective taxes should then be reduced (equalized), as high taxes should continue to act as a deterrent to starting consumption.

Figure 4. Productivity loss from death and disability from alcohol, tobacco, and SSBs, and corrective taxes levied on these products, 2019 or nearest year



Sources: See Figure 2a; authors' compilation of corrective tax revenues.

4. Economic costs and corrective taxes by risk factor

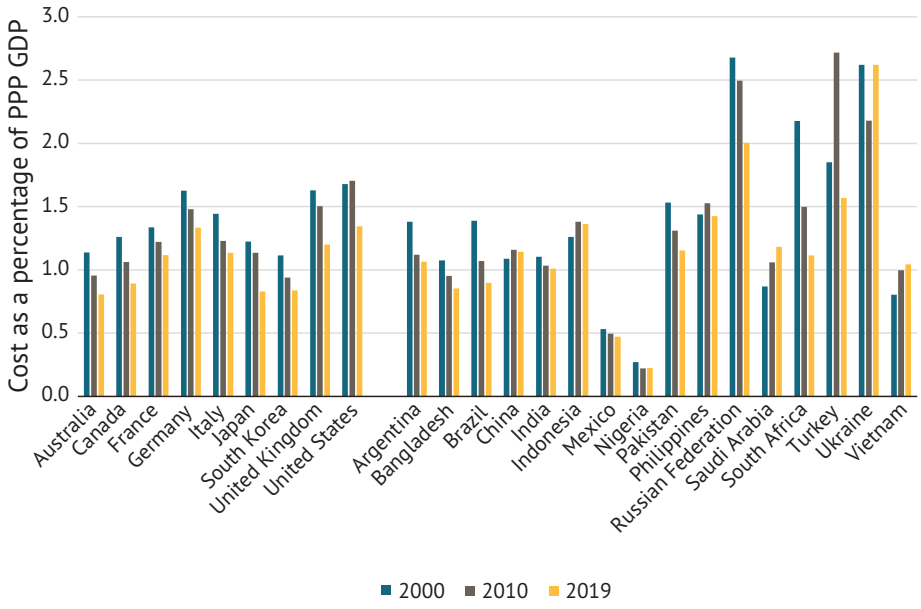
4.1. Tobacco

Advanced economies in our sample have reduced premature deaths from tobacco use by 16 percent since 2000, while years lived with disability rose slightly over the same period; in emerging markets, deaths attributable to tobacco use have risen by 10 percent, and disability by nearly 40 percent. In a few large emerging markets, notably Indonesia, the Philippines, and Saudi Arabia, mortality has risen by over 50 percent.

The economic costs of death and disability follow similar trends in advanced economies, with small increases in labor market size accentuating the declines in prevalence (Figure 5). In emerging markets, the labor force expansion has a stronger effect in reducing prevalence and economic costs expressed as a share of GDP. Appendix 2 compares these estimates

with those developed for 2012 by Goodchild, Nargis, and Tursan d'Espaignet (2017) using a similar methodology.

Figure 5. Tobacco: Productivity loss from mortality and disability, 2000–2019 (as a percentage of PPP GDP)

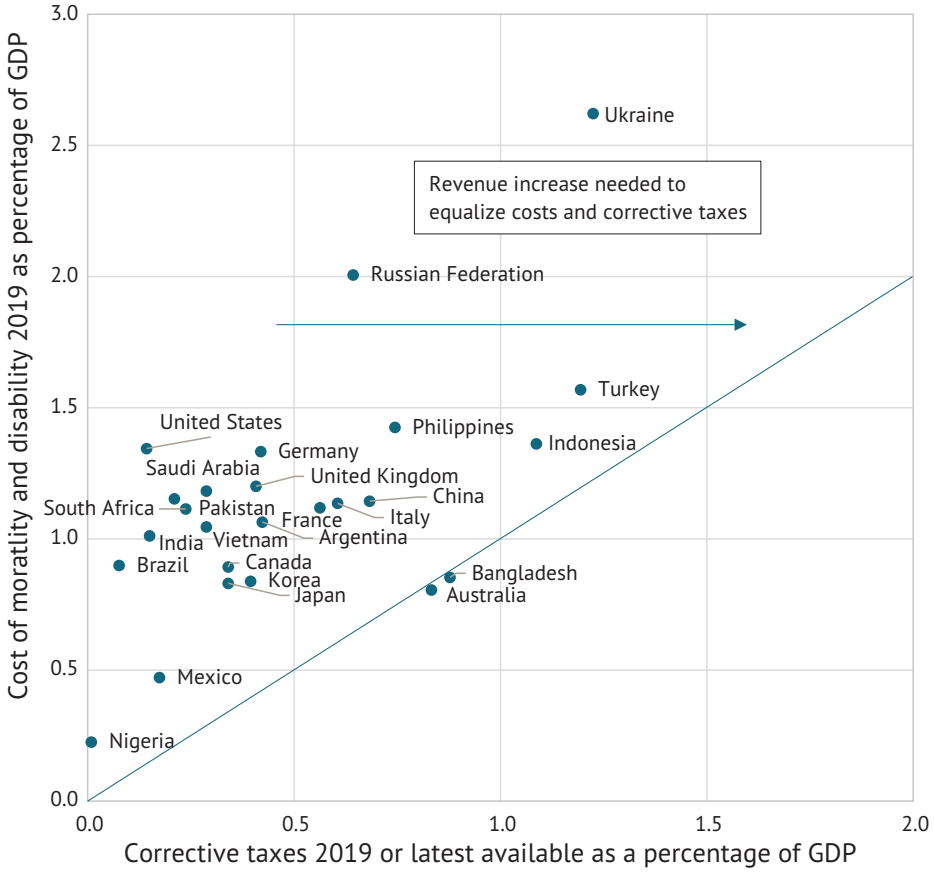


Sources: See Figure 2a.

Corrective taxes on tobacco remain low relative to the economic costs of death and disability in almost all countries (Figure 6). On average, taxes would need to rise by 0.67 percent of GDP, or more than double current collections, to match the indirect economic costs. Only two countries (Australia and Bangladesh) raise corrective taxes in an amount equivalent to indirect costs: the former because of large corrective tax increases in recent years, and the latter perhaps because of high smoking prevalence among young people.

Estimates of tobacco-attributable medical costs would, however, suggest additional room for corrective tax increases. Goodchild, Nargis, and Tursan d'Espaignet (2017) estimate the tobacco-attributable total health expenditure in 2012 for 152 countries as equivalent to 0.5 percent of global GDP. In the country sample used in this paper, excluding Nigeria where no estimates are available, their estimate of total health expenditure averages 0.4 percent of GDP. More recent estimates of the medical costs of tobacco-attributable diseases are also comparable in magnitude including Bangladesh (2018) 0.4 percent of GDP (Nargis et al. 2021); Mexico (2019) 0.35 percent of GDP (García Gómez et al. 2020); Sri Lanka (2015) 0.35 percent of GDP (WHO 2017); and Vietnam (2011) 0.49 percent of GDP (Hoang et al. 2014).

Figure 6. Tobacco: productivity loss from mortality and disability, and corrective taxes, 2019 or latest year (as a percentage of GDP)

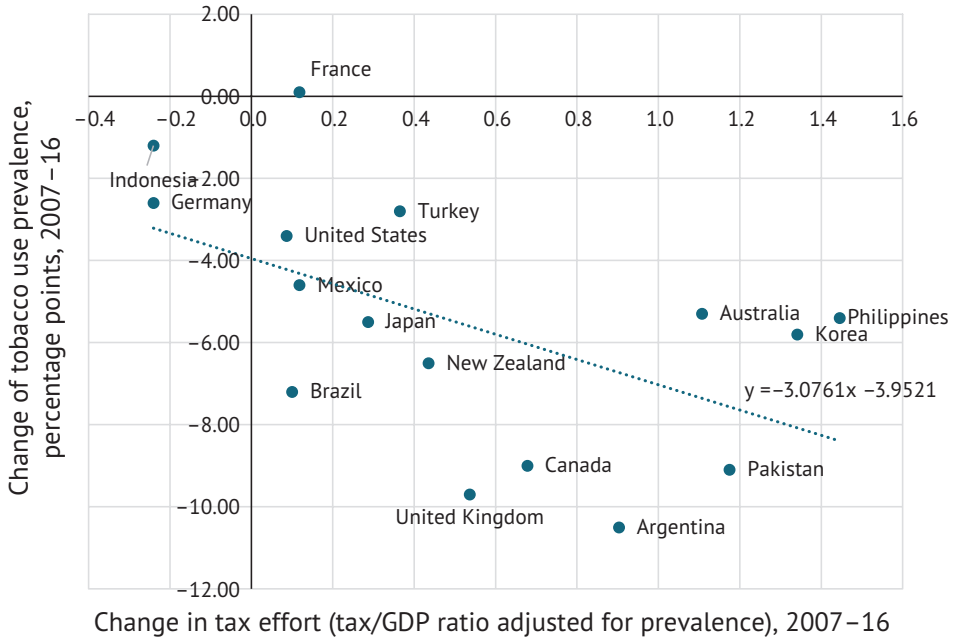


Sources: See Figure 2a; authors' compilation of corrective tax revenues.

What evidence is there that higher tobacco use taxes deter tobacco use?

We propose a new measure of tax effort to demonstrate that higher taxes on tobacco are associated with lower tobacco use prevalence. Our measure of tax effort considers corrective tobacco tax revenues as a share of GDP and adjusts it for tobacco use prevalence as measured by prevalence surveys, that is, tax effort = corrective tobacco tax as a share of GDP/tobacco use prevalence. For example, if a country maintains corrective tax collection constant as a share of GDP while tobacco use prevalence declines, then tax effort has increased.

Figure 7. Corrective tax effort and change in tobacco use prevalence, 2007–16



Note: Based on WHO estimates of tobacco use prevalence among both sexes, age-standardized rate; tax effort = (corrective tax/GDP)/tobacco use prevalence.
Sources: WHO Global Health Observatory, https://www.who.int/data/gho/indicator-metadata-registry/imr-details/128; authors' compilation of corrective tax revenues.

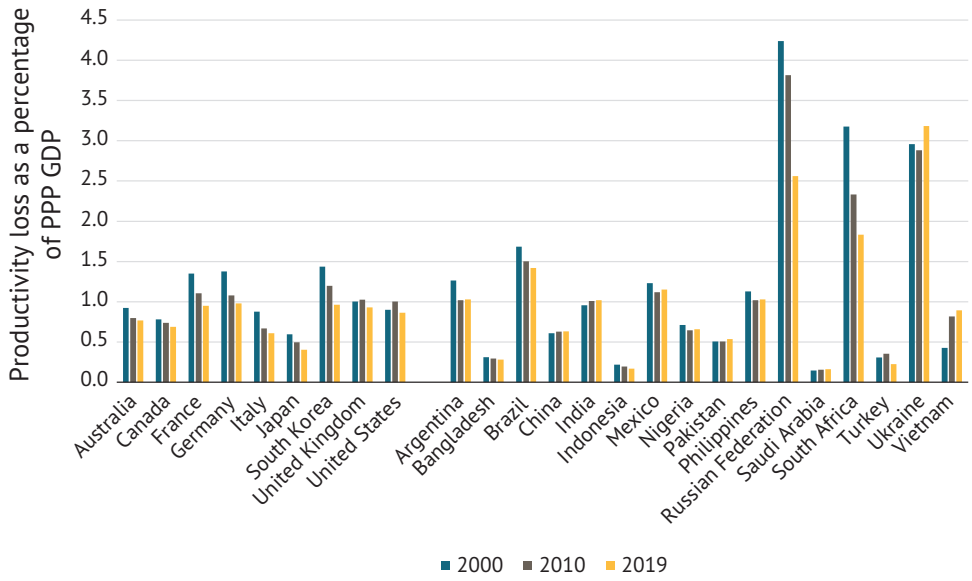
Using corrective tax and tobacco use prevalence data for 2007 and 2016 for 16 countries, we show that increases in tax effort are associated with a greater reduction in tobacco use prevalence (Figure 7). While the sample shows that there is a trend of reduction in tobacco use prevalence of 3.9 percent even with no change in tax effort (the intercept on the vertical-axis)—likely a result of other tobacco control policies—increased tax effort results in stronger reductions in tobacco use prevalence (New Zealand, the United Kingdom, Canada, Argentina, Pakistan, Australia, South Korea, and the Philippines), while a reduction of tax effort results in a marginal decline or increase in tobacco use prevalence (Indonesia and Germany). With modestly increased tax effort, there is greater variation in prevalence changes (Brazil, Mexico, Japan, the United States, Turkey, and France). These results could be strengthened with additional data, as, for example, the change in tax effort is affected by the start and end years selected.

4.2. Alcohol

Premature deaths from alcohol use have hovered close to 1 million a year during the 2000–2019 period (25-country sample, 20–65 age cohort), with no change in advanced economies and modest increases in emerging markets. Years lived with disability rose over the same period (from 9 million to 10.5 million), with the increases predominantly registered in emerging markets.

Although absolute numbers of deaths and disabilities have edged up, the cost of death and disability as a percentage of GDP has in most countries edged down, as increases in the labor force have outpaced case growth and incidence overall has fallen (Figure 8). Ukraine, Russia, and South Africa stand out as having particularly elevated costs arising from death and disability, although these costs decreased in Russia and South Africa over the period. Costs have risen in India and Vietnam, mainly as a result of increased alcohol-attributable disability.

Figure 8. Alcohol: Productivity loss from mortality and disability, 2000–2019 (as a percentage of PPP GDP)

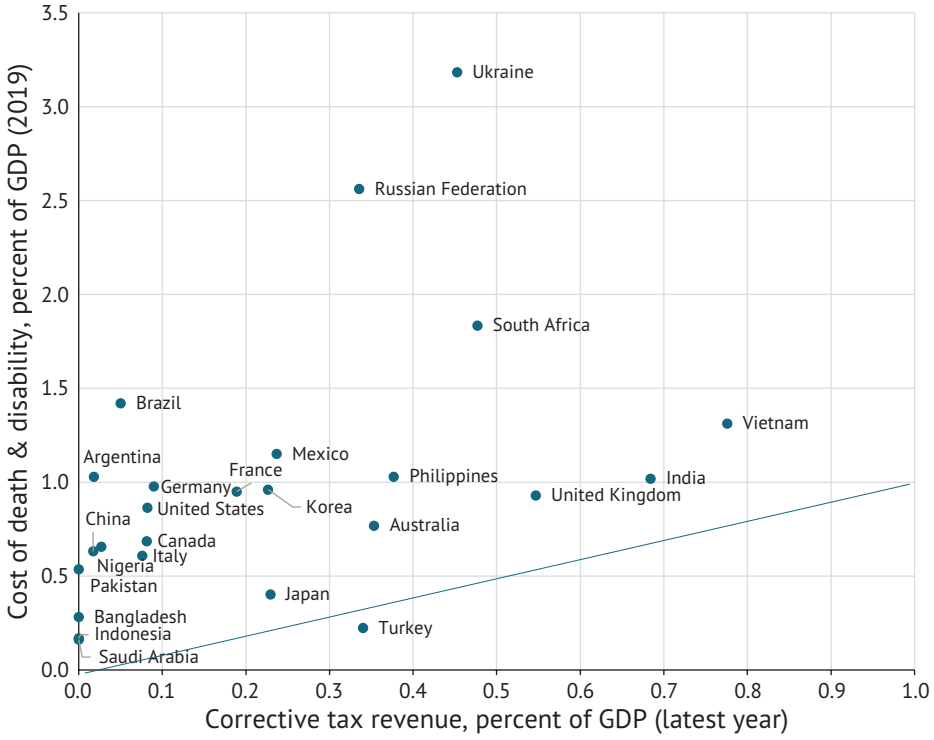


Sources: See Figure 2a.

Corrective taxes on alcohol are very low relative to the economic costs of death and disability in almost all countries (Figure 9). On average, taxes would need to rise by 0.7 percent of GDP, or quadruple current collections, to match the indirect economic costs. Only one country, Turkey, levies corrective taxes in an amount greater than the indirect costs considered here, reflecting large corrective tax increases in recent years that raised the price of alcoholic drinks by 1,800 percent between 2001 and 2020 while taxes on alcohol and tobacco account for 12 percent of total tax revenue in Turkey.[14]

[14] https://balkaninsight.com/2020/10/15/turkeys-punishing-taxes-fuel-craze-for-risky-homemade-booze/.

Figure 9. Alcohol: Productivity loss from mortality and disability, and corrective taxes (as a percentage of GDP)



Sources: See Figure 2a; authors' compilation of corrective tax revenues.

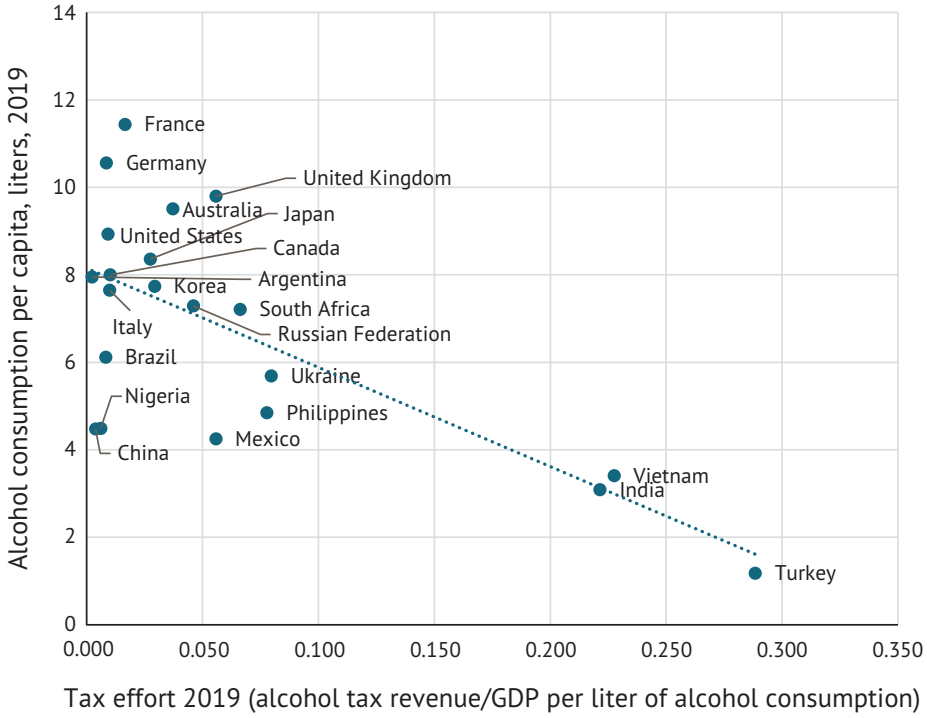
Estimates of alcohol-attributable medical costs and other costs also warrant corrective tax increases. Rehm et al. (2009) review cost estimates and find alcohol-attributable health care costs of 0.3–0.4 percent of GDP in France, the United States, and Canada (1997–2002), and 0.2 percent of GDP in South Korea (2002). In addition, they find law enforcement costs and other direct costs account for 0.4 percent of GDP in France, the United States, and Canada, and 0.7 percent of GDP in South Korea. Another review, by Baumberg (2006), finds medical costs of 1.3–2.3 percent of GDP in Canada, 2.3 percent of GDP in Germany, and 1.5 percent of GDP in the United States, with significant additional expenditures of a similar magnitude for public order and safety, and road traffic accidents. Jyani et al. (2019) model gross direct and indirect costs of alcohol (health system costs, out-of-pocket expenditures, and productivity losses) at 1.8 percent of GDP in India, compared to direct costs of only 1.0 percent of GDP estimated in this paper for 2019.

Do corrective taxes on alcohol affect consumption?

We construct a variable for corrective tax effort on alcohol by calculating the tax-to-GDP yield per 1 liter of alcohol consumption per person per year (Figure 10). While it appears that higher taxes are associated with lower consumption, there is a great deal of variation in consumption around relatively low tax effort. Tax receipts may be affected by differential

taxation across types of alcohol products (beer, wine, spirits), and alcohol consumption data may not fully reflect noncommercial alcohol consumption, which complicates interpretation of cross-country comparisons.

Figure 10. Alcohol consumption and corrective taxes on alcohol



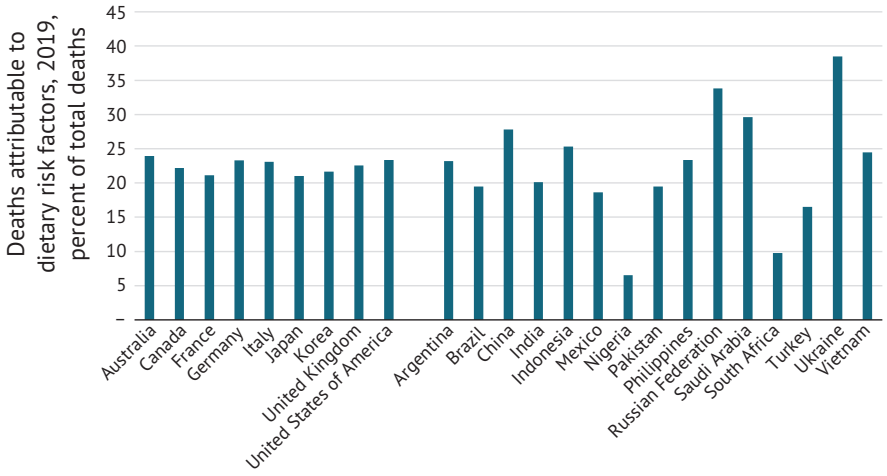
Sources: WHO Global Health Observatory, https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/levels-of-consumption; authors' compilation of tax receipt data.

4.3. Diets high in sugar-sweetened beverages

Dietary risk factors are a major driver of noncommunicable diseases and death in middle- and high-income countries, reflecting a shift in consumption from unprocessed to processed foods. In advanced economies, risk factors attributable to poor diet account for more than 20 percent of total deaths, a share that is matched or exceeded in about half of the emerging markets, especially those with higher per capita incomes (Figure 11).[15]

[15] Dietary risk factors identified by the Institute for Health Metrics and Evaluation's Global Burden of Disease are diets high in processed meat, red meat, sodium, SSBs, and trans fatty acids and diets low in calcium, fiber, fruits, legumes, milk, nuts and seeds, polyunsaturated fatty acids, omega-3 fatty acids, vegetables, and whole grains.

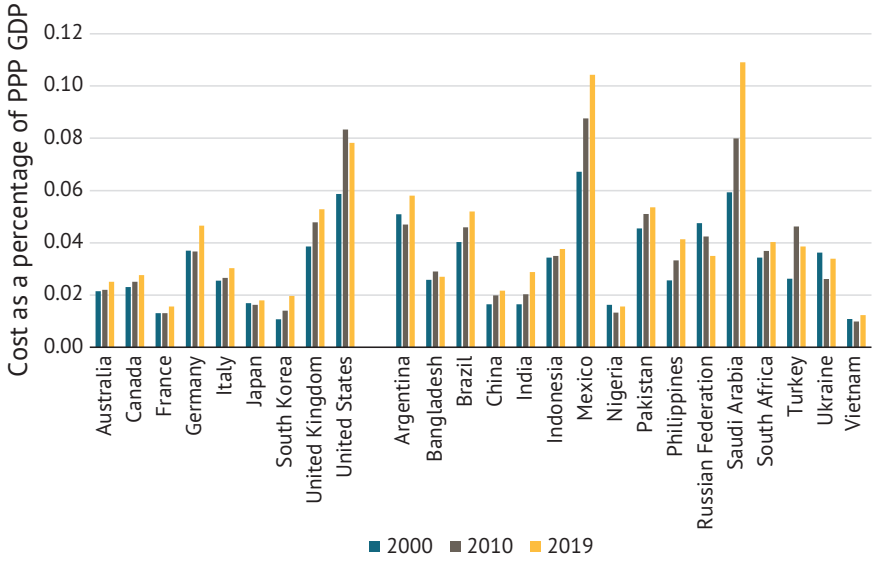
Figure 11. Deaths attributable to dietary risk factors, percent of total deaths, 2019



Source: IHME GBD 2019.

While SSB consumption represents a relatively small fraction of total dietary risk factors, it has been increasing rapidly and can be targeted with corrective taxes in a relatively straightforward manner, as SSBs are a distinct product category (unlike, say, added salt). The costs of lost productivity due to SSB-attributable death and disability have risen rapidly in the United States, Mexico, and Saudi Arabia in our country sample (Figure 12), and these three countries have recently introduced SSB taxes at the national or subnational level. In these cases and others, the primary purpose of SSB taxes is not to raise revenue but to change consumer preferences to less-sweetened beverages and to encourage producers to reformulate products with less sugar.

Figure 12. Sugar-sweetened beverages: productivity loss from mortality and disability, 2000–2019 (as a percentage of PPP GDP)



Sources: See Figure 2a.

In our country sample, the introduction of SSB taxes is relatively recent, and the structure of the tax applied differs across countries, with specific, tiered specific, and ad valorem excises applied (Table 1).

Table 1. Taxes on sugar-sweetened beverages: structure and revenue

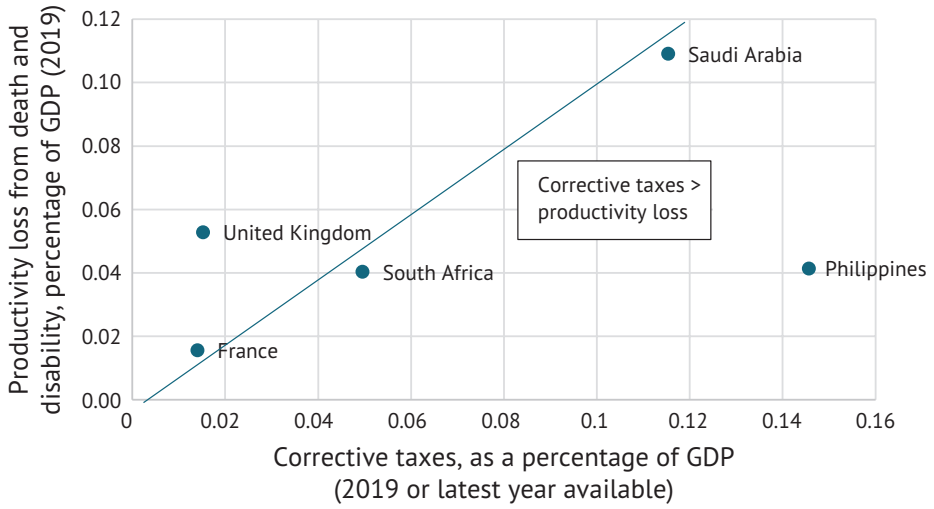
Country	Year of Introduction	Policy Instrument	Amount of Tax	Tax Collected	Products Subject to the Tax	Notes
France	2012, revised 2018	Specific excise tax, sugar based	From 2018 sliding scale tax rising to €0.20 per L (US$0.23 per L) on drinks with >11 g sugar per 100 ml	€300 million (2014) 1/	Drinks with added sugar and artificial sweeteners, including sodas, fruit drinks, flavored waters, and "light" drinks	Revenue used for the general budget; replaced €0.11 (US$0.12) per 1.5 liters volume-based tax in effect since 2012
India	2017	General sales tax (surcharge)	40% (28% general sales tax + 12% cess—tax upon a tax)	Not available	Includes aerated waters and drinks containing added sugar or other sweetening matter or flavor	Applies nationally and replaces all other general sales tax laws at the state level
Philippines	2018	Specific excise tax, volume based	PHP 6 per liter (around US$0.12) on drinks containing sugar and artificial sweeteners; PHP 12 per liter (around US$0.24) on drinks containing high fructose corn syrup	PHP 26.6 billion (2018) 2/	Juices, tea, carbonated beverages, flavored water, energy and sports drinks, powdered drinks not classified as milk, coffee, cereal and grain beverages	Exempt: 100% natural fruit and vegetable juices, milk products, meal replacement and medically indicated beverages
Saudi Arabia	2017	Ad valorem excise tax	100% on energy drinks; 50% on all SSBs	SAR 3.4 billion (2018) 3/	All drinks with added sugars	Previously applied only to energy drinks and carbonated soft drinks
South Africa	2018	Specific excise tax (sugary beverages levy)	ZAR 0.021 (US$0.0015) per gram sugar over 4 g per 100 ml (effective tax rate approximately 12%)	ZAR 2513 million (2019) 4/	Sugary beverages (mineral and aerated waters containing added sugar or other sweeteners or flavors and other nonalcoholic beverages) that contain >4 g per 100 ml	Exempt: Fruit and vegetable juices, dairy drinks, and drinks that contain <4 g sugar per 100 ml

Country	Year of Introduction	Policy Instrument	Amount of Tax	Tax Collected	Products Subject to the Tax	Notes
United Kingdom	2018	Specific excise tax (Soft drinks industry levy), tiered volume based	€0.18 per liter (US$0.25) for drinks with 5–8 g total sugar per 100 ml; €0.24 per liter (US$0.34) on drinks with >8 g total sugar per 100 ml	€336 million (2019) 5/	Any prepackaged soft drink with added sugar containing at least 5 g of total sugars per 100 ml, produced and packaged in the United Kingdom and soft drinks imported into the United Kingdom	Exempt: Milk-based drinks, milk substitute drinks, pure fruit juices or any other drinks with no added sugar, alcohol substitute drinks, and soft drinks used for medicinal or other specified purposes

Sources: World Bank, 2020, Support for Sugary Drinks Taxes: Taxes on SSBs Summary of International Evidence and Experiences, except where noted.
Notes: 1/ WHO, 2015, Fiscal policies for diet and NCDs; 2/ https://www.foodnavigator-asia.com/Article/2019/10/16/Sugar-tax-dismay-Philippines-senate-highlights-failure-of-revenue-payout-to-sugar-industry#; 3/ IMF, 2019, Saudi Arabia: Selected Issues, https://www.imf.org/en/Publications/CR/Issues/2019/09/09/Saudi-Arabia-Selected-Issues-48660; 4/ South African Revenue Statistics, https://www.sars.gov.za/about/sas-tax-and-customs-system/tax-statistics/; 5/ OECD Revenue Statistics, https://www.oecd.org/governance/revenue-statistics-2522770x.htm.

Tax revenue data available for five countries in our sample with SSB taxes show a reasonable alignment of corrective taxes with the productivity losses from death and disability (Figure 13), particularly in comparison to corrective taxes on alcohol and tobacco, which are mostly a small fraction of productivity losses. France, Saudi Arabia, and South Africa have corrective tax collections broadly in line with productivity losses; the Philippines has relatively high corrective taxes; and the United Kingdom has relatively low corrective taxes.

Figure 13. Sugar-sweetened beverages: productivity loss from mortality and disability, and corrective taxes (as a percentage of GDP)



Sources: See Figure 2a; authors' compilation of corrective tax revenues.

Although SSB taxes are relatively recent, there is a considerable body of research on their impact, which concludes that the impact on consumption is maximized where a high level of tax is levied (over 20 percent ad valorem) and where the initial level of annual SSB consumption is high (e.g., over 100 liters per capita per year). A systematic review of 17 studies concludes that a 10 percent SSB tax was associated with a 10 percent decline in purchases and dietary intake (Teng et al. 2019). Alsukait et al. (2020) find that the 50 percent ad valorem tax on SSBs in Saudi Arabia reduced consumption by 33 percent relative to sales of untaxed beverages. Capacci et al. (2019) consider France's 2012 volume-based SSB tax, which was approximately 10 percent of price, and conclude that it at most led to a very small reduction in purchases (subsequently France's SSB tax was increased for high-sugar SSBs). Law et al. (2021) assess India's soft drink tax (12 percent) and conclude that it did not reduce purchases in urban areas, possibly because India has relatively low consumption of these products per capita.

5. Conclusions

In our sample of 25 large advanced and emerging markets accounting for three-quarters of global GDP, we show that about 60 million productive life years were lost every year in 2000, 2010, and 2019 due to alcohol-, tobacco-, and SSB-attributable death and disability. Levels of death and disability are beginning to drop in the advanced economies but continue to rise in emerging markets.

We calculate the economic value of these lost productive life years, which amounts to just under 2 percent of GDP in advanced economies and 2.3 percent of GDP in emerging markets, although with a few countries in the much higher 3–6 percent of GDP range (Russia, South Africa, and Ukraine). Costs as a share of GDP are declining in advanced economies and some emerging markets but remain stable or are rising in a significant number of emerging markets, including China, India, and Indonesia.

We then analyze how collections from corrective taxes on alcohol, tobacco, and SSBs compare to the value of lost productive life years, with some reference also to other direct costs (medical costs and other externalities) using a database for tax collections we compiled from published sources.

We find that none of our 25 countries raise corrective taxes equivalent to the total productivity loss from alcohol, tobacco, and SSBs, and on average would need to triple these tax collections, increasing them by an amount equivalent to 1.4 percent of GDP, to close the tax gap. The increase would need to be significantly more in countries with the largest gaps between productivity loss and corrective taxes (Ukraine, Russia, and South Africa).

For tobacco, we show that only 2 out of 25 countries collect corrective taxes in an amount equivalent to the tobacco-attributable death and disability productivity losses, and that half of the overall corrective tax gap, or 0.7 percent of GDP, is linked to tobacco. The gap is significantly higher—by about another 0.4 percent of GDP—when tobacco-attributable

medical costs are also taken into account. We also show that increased tobacco tax collections (over 10 years, after adjusting for changes in prevalence of tobacco use) are correlated with greater declines in tobacco prevalence and are helping advanced countries to significantly reduce tobacco use prevalence.

The story for corrective taxes on alcohol is similar to that for taxes on tobacco. Only one country raises corrective taxes equivalent to or more than the relevant productivity loss (Turkey), and the tax shortfall is also 0.7 percent of GDP on average. However, the starting base for alcohol taxes is significantly lower than for tobacco taxes, so tax collections would need to be at least quadrupled to close the corrective tax gap, on average. If we were to take into account other externalities such as crime and accidents, the corrective tax gap would be significantly larger. Again, the evidence suggests that greater effort in collecting corrective taxes—that is, higher tax collections adjusted for consumption—is correlated with lower alcohol consumption.

Finally, we consider SSB taxes as an illustration of using corrective taxes to incentivize healthier diets and to reduce death and disability from these risk factors. In three out of the five countries that have both SSB taxes and data on revenue collections, we find that corrective taxes on SSBs are more in line with productivity losses than is the case for taxes on tobacco or alcoholic beverages, suggesting that the calibration of these relatively new corrective taxes is broadly in line with the losses caused by the product. SSB taxes are likely to be most effective if set at relatively high rates (above 20 percent ad valorem equivalent) in countries with high SSB consumption (over 100 liters per person per year).

Overall, there remains very significant scope for corrective taxes to help counter the persistent and large economic costs arising from tobacco-, alcohol-, and SSB-attributable death and disability in both advanced and emerging economies. The challenge is for policymakers to recognize these costs and realign corrective taxes accordingly.

Appendix 1. Methodology for calculating economic costs of consumption

We closely follow the approach set out by Goodchild, Nargis, and Tursan d'Espaignet (2017) for calculating the indirect cost of lost productivity from alcohol-, tobacco-, and SSB-attributable death and disability. The economic value of lost production from years of life lost (up to age 65) and years lived with disability is the purchasing power parity (PPP) GDP per worker after adjusting total years of life lost for labor force participation rate by sex and for life expectancy by sex—that is, an economic cost occurs for death and disability attributable to people in the labor force, adjusted for the proportion of each age cohort that is expected to reach the age of 65, using WHO life tables. The PPP indirect costs are expressed as a share of PPP GDP to enable comparisons across countries.

We calculate the value in PPP$ of labor productivity loss due to death and disability for risk factor *r* in country *i* at time *t*.

Death

D_WAPrjit = Deaths in the working age population for risk factor *r*, gender *j*, in country *i*, at time *t*. Working-age population is ages 20–65 years for each 5-year age cohort.

LYLrjit = Labor years lost to age 65 at retirement, which is calculated as 65 – median age in age cohort for risk factor *r*, gender *j*, in country *i*, at time *t*.

We adjust *LYLrjit* for survival rates by age cohort and gender using WHO survival rates variable *Lx*. We further adjust the labor years lost for the labor force participation rate (i.e., assuming that deaths occurring to people not in the labor force do not have a productivity loss) using World Bank WDI data for labor force participation by gender (employment to population ages 15–64 using the modeled International Labour Organization estimate).

djLYLrjit = *LYLrjit* * survival rate factor *rjit* * labor force participation *LFPjit*

Value of labor productivity loss is calculated by multiplying adjusted labor years lost by World Bank WDI PPP GDP per worker expressed in constant 2017 PPP$. This is scaled as a share of PPP GDP at 2017 constant prices. For simplicity, we do not inflate future labor years' productivity value by assumptions on per capita productivity growth nor deflate using a discount rate. All data are in unadjusted 2017 PPP share of GDP.

Disability

We use disability-adjusted life years (DALYs) lost for each risk factor *r*, gender *j*, in country *i*, at time *t*. *DALYrjit* is calculated as the number of new case incidents multiplied by disability weight multiplied by the duration of disability to death or remission.

We value *DALYrjit* using the same approach as for labor years lost using PPP GDP per worker.

Our sample of countries is the 19 countries in the G-20 plus 6 large emerging markets (Bangladesh, Nigeria, Pakistan, the Philippines, Ukraine, and Vietnam).

Our time periods are 2000, 2010, and 2019.

All data on death and disability are obtained from the Institute for Health Metrics and Evaluation Global Burden of Disease database at http://ghdx.healthdata.org/gbd-results-tool.

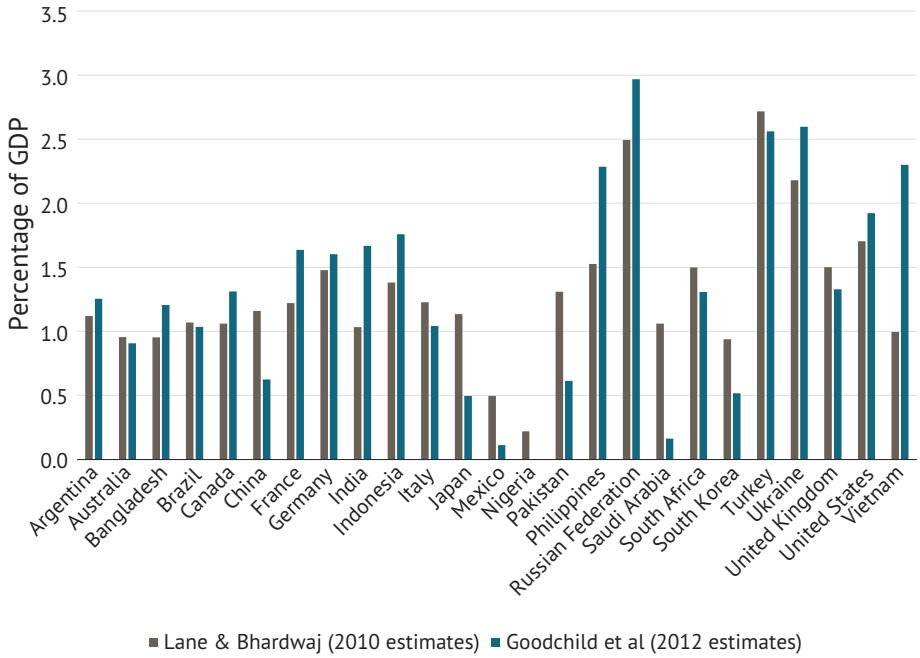
All World Bank World Development Indicators data are obtained from https://databank.worldbank.org/source/world-development-indicators.

Appendix 2. Benchmarking death and disability costs

Goodchild, Nargis, and Tursan d'Espaignet (2017) calculate estimates of the death and disability costs of tobacco-attributable diseases for 2012 for all countries. Their estimates differ from this paper's in several respects: (1) mortality data were available for only two age cohorts (30–59 and 60–69), and the age of retirement is assumed to be 69, compared to this paper's use of nine age cohorts and a retirement age of 65; (2) estimates of morbidity (disability-adjusted life years) were estimated for 2012 based on 2004 data; (3) labor years lost were calculated using the World Bank employment-to-population ratio for each country, whereas this paper uses World Bank labor force participation rates for the population ages 15–64; and (4) the present value of productivity lost to mortality assumed that productivity grows at International Monetary Fund projections of GDP per capita and a discount rate of 3 percent was applied, whereas this study does not make these largely offsetting adjustments. Overall, it is difficult to assess how these methodological differences would affect results: difference (1) with a higher retirement age is likely to increase the costs calculated by Goodchild, Nargis, and Tursan d'Espaignet compared to those identified in the current paper; differences (2) and (3) lead to more granular data in this paper; and difference (4) may decrease Goodchild, Nargis, and Tursan d'Espaignet's estimates for slow-growing countries (less than 3 percent per capita growth) and increase estimates for fast-growing ones.

Notwithstanding these methodological differences, results for Goodchild, Nargis, and Tursan d'Espaignet for 2012 and this paper for 2010 are generally very consistent with adjustment (1) for retirement age, with a few exceptions—notably higher estimates in this paper for Japan, South Korea, Mexico, Pakistan, and Saudi Arabia and lower estimates for Vietnam (Figure A2.1).

Figure A2.1. Tobacco: comparison of productivity losses from mortality and disability from different sources



Sources: Authors' estimates; Goodchild, Nargis, and Tursan d'Espaignet (2017).

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