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Indian sugar policies: connecting production, consumption, and health

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Abstract Sugar is one of the most regulated agricultural commodities in India. Every stage of its value addition has some mechanism of government support. Sugar emerges to be an interesting case study which shows how one market distortion triggers a spate of distortionary policies resulting in a highly distorted domestic sugar market, which at many times stands alienated from its global reference prices. The observed and estimated costs (actual and implied) of policy interventions by the government in the cane and sugar industry are high and have been rising overtime. Combining them with the high environmental and social costs, there emerges a need for a course correction in policies.

Keywords sugar, India, diets, nutrition, obesity, sugar exports, subsidies

JEL codes H25, I18, Q17, Q18

Sugar is one of the most tightly regulated agricultural commodities in India. It is also one in which almost every stage of its value addition has some mechanism of governmental support. It is one sector where not just the cane farmers, but also the cane millers get significant support from the government. Besides, in providing support to the processors/millers, the governmental policies are also effectively ‘taxing’ sugar consumers in the country.

In 2021-22, India was the second largest producer of sugarcane in the world. Despite growing diversion to ethanol, rising consumption both by industries and individual consumers, the country has been able to generate large sugar surpluses. These surpluses have supported in strengthening India’s position as a global sugar exporter. However, not just is sugarcane a water guzzler and thus has obvious environmental costs, its higher consumption has been increasingly associated with deteriorating health outcomes. In this paper, the sugarcane policy environment in the country is outlined and is used to showcase how one distortion in policy snowballs into an intricate web of distortions leading

to sometimes, inefficient outcomes.

The report is organized in nine sub-sections. The Indian sugar and cane production and consumption trends are profiled in first two sections, followed by India’s sugar trade trends. An analysis of key health metrics concerned with sugar are presented in the next section. The structure of the Indian sugar value-chain is explained in the next, followed by a listing of the key governmental programs and schemes for cane and sugar. An analysis of the level of fiscal (or budgetary) support given to the cane and sugar industry is presented next followed by the qualitative insights on sugar costs and benefits. The paper ends with policy recommendations.

Production of cane and sugar

Sugarcane is one of the most important crops globally as it provides raw material, both for food and fuel. More than 100 million individuals around the world depend on sugarcane cultivation and processing for livelihoods (IISD 2019). Since 1961, global sugarcane production

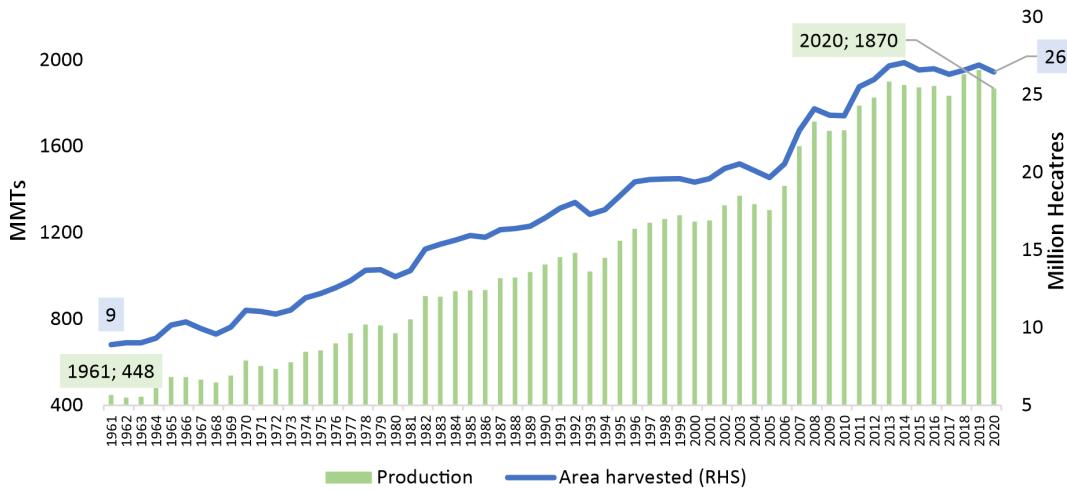


Figure 1 Global sugarcane since 1960: area (Mn Ha) and production (MMTs)

Source FAO

has increased fourfold, from 448 million metric tons (MMTs) to 1870 MMTs in 2020. In the same period, area under sugarcane increased about 3 times, from about 9 million hectares to 26 million hectares (Figure 1).

Globally, about 77 per cent of the cane comes from four countries: Brazil (39 per cent), India (20 per cent), China (12 per cent) and Thailand (6 per cent).

Cane is mostly used as raw material for the production of sugar. A small quantity of sugar is also produced from sugar beet (FAO 2022). Globally, 80 per cent of

sugar is derived from sugarcane (ISO 2022). In India, production of sugar is almost solely from sugarcane (Mall et al. 2021).

The sugar content of cane ranges approximately between 8 to 15 per cent. (FAO 2022 and ICAR 2022). For triennium ending (TE) 2021, 170 MMTs of sugar (from cane and beet) was produced globally (ISMA). Eight countries produced about 70 per cent of this: Brazil (18 per cent), India (18 per cent), European Union (10 per cent), Thailand (7 per cent), China (6 per cent) and US, Russia and Mexico about 4 per cent each (USDA) (Figure 2).

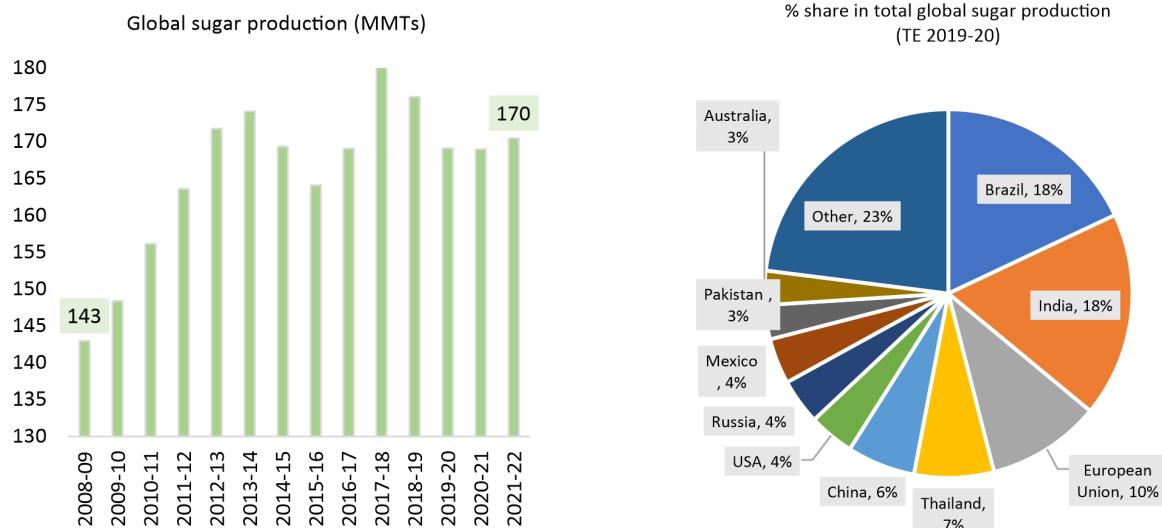


Figure 2 Global sugar production (MMTs) and its Geography (% global production)

Source ISMA and USDA

Note Reported number is sugar produced from both cane and beet

Indian cane and sugar

India is the second largest producer of sugarcane in the world. In TE 2020-21, 4.8 million hectares was under sugarcane cultivation in the country, producing on average 394 MMTs of sugarcane. On average, about 75 per cent of sugarcane in India is used to produce white sugar, 13 per cent to produce *gur* (Jaggery) and the rest 12 per cent for seed/feed production (ISMA 2021). Production of sugar is largely dependent on the recovery rate¹ of sugar from sugarcane. In recent years, the recovery rate has gone up, mainly due to varietal improvement of sugarcane. In TE 2020-21, 31 MMTs of sugar was produced in the country (ISMA 2021).

Geographically, both cane and sugar production is highly concentrated in a few states in the country. In case of cane, three states account for about 77 per cent of all-India production (Figure 3): Uttar Pradesh (47 per cent), Maharashtra (21 per cent) and Karnataka (9 per cent) (TE 2019-20). Out of the 461 operational sugar factories in India in 2019, 26 per cent were in Uttar Pradesh, 31 per cent were in Maharashtra and 14 per cent were in Karnataka (ISMA 2020).

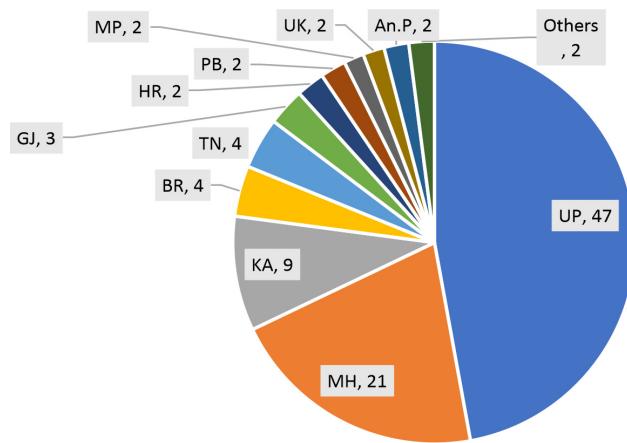


Figure 3 State-wise share in cane production (TE 2019-20)

Source Ministry of Agriculture & Farmers' Welfare (GoI)

Note UP is Uttar Pradesh, MH is Maharashtra, KA is Karnataka, BR is Bihar, TN is Tamil Nadu, GJ is Gujarat, HR is Haryana, PB is Punjab, MP is Madhya Pradesh UK is Uttarakhand, An.P is Andhra Pradesh

Consumption of sugar in India

India emerges to be the largest consumer of sugar in the world (ISMA 2021). In TE 2019-20, almost 50 per

cent of global sugar production was consumed in five countries: India (16 per cent), European Union (11 per cent), China (9 per cent), USA (6 per cent) and Brazil (6 per cent) (Figure 4).

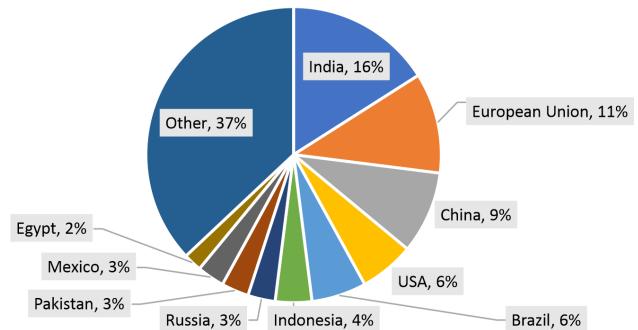


Figure 4 Global consumption of sugar: share of countries (TE 2019-20)

Source USDA

Despite the large value of consumption and production, per capita sugar availability in India is much lower than the global average. The estimate of per capita availability of sugar in India comes out to be about 19.3 kg per person per year, whereas the global average is of about 22.1 kg per person per year. (ISO 2019 and ISMA 2021).

Trends in sugar consumption

To estimate the level of per capita sugar consumption, we used the household-level data from Government of India's (GOI) consumer expenditure surveys. The latest data is available for 2011-12 as the 2017-18 Consumption Expenditure Survey was retracted by GOI "in view of the data quality issues" (PIB 2019).

Among other things, as part of the survey by National Sample Survey Office (NSSO), the respondents were asked about their consumption of the raw sugar consumption (sourced from Public Distribution System- PDS and other sources), consumption of fruit juices and shakes, prepared sweets, cake & pastry, biscuits & chocolates, and sauce, jams, and jellies. A snapshot of the estimates of per capita consumption for the following commodities is given in Table 1.

For this study, we have only looked at raw sugar consumed from PDS and 'other' sources which excludes sugars naturally present in fruits, honey,

¹Recovery rate is the amount of sugar extracted from sugarcane. Higher the recovery rate, more expensive is the cane in India.

Table 1 Consumption of various raw and processed sugars (per capita per month)

Commodity name	Unit	All India per capita consumption	
		2011-12	2004-05
Sugar-PDS	Kilograms	0.10	0.06
Sugar-Other	Kilograms	0.64	0.63
Fruit juice and shake	Litre	0.01	0.01
Prepared sweets, cake, pastry	Number	0.00	0.01
Biscuits, chocolates, etc.	Number	0.00	0.20
Sauce, jam, jelly	Grams	1.85	0.75

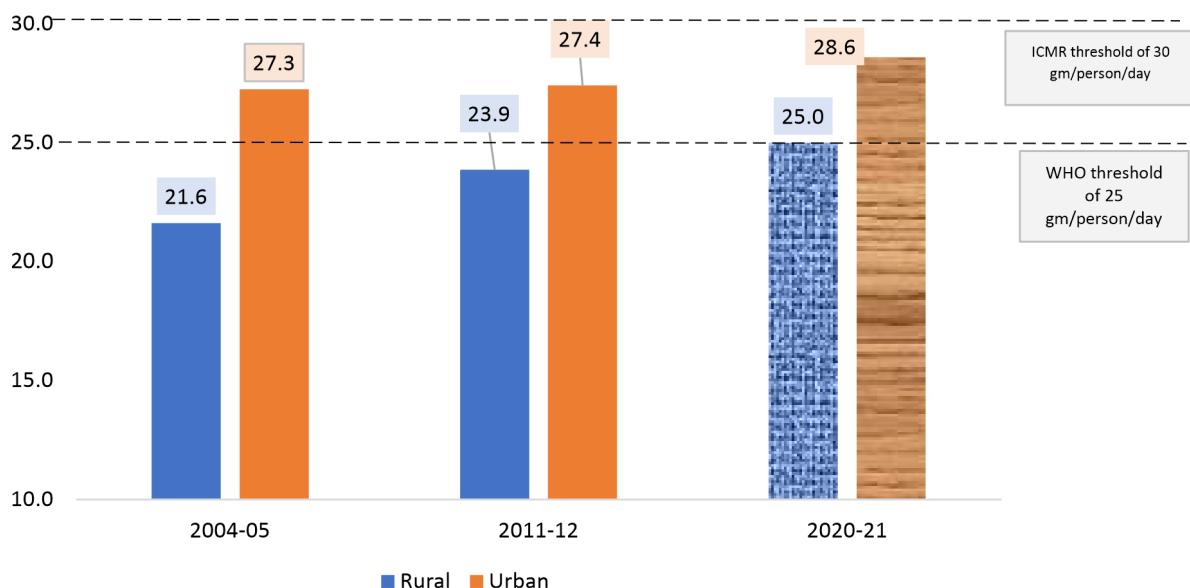
Source Estimated by authors using unit level data from NSSO: 2004-05 and 2011-12.
The data is for year July-June.

sweeteners, etc. Also, we have not included sugar intake via processed commodities such as biscuits, chocolates, jams, and other processed food.

As per NSSO data, India has seen increasing sugar consumption over the years. In 2011-12, average per capita raw sugar consumption in India was about 23.9 grams per day in rural areas and 27.4 grams per day in urban areas. The corresponding numbers in 2004-05 were 21.6 and 27.3 respectively. Consumption clearly has grown in both areas; however, the cumulative annual growth rate (CAGR) is higher for rural areas (1.46 per cent) compared to urban areas (0.05 per cent) (Figure 5).

Despite the rise, Indian sugar consumption levels on average have been below or close to the recommended threshold levels of sugar. As per Indian Council of Medical Research (ICMR), the recommended threshold level of sugar consumption is about 30 gm per person per day and as per the WHO, recommended threshold intake is about 25 grams per day. Both the thresholds have been plotted as dotted lines in Figure 5.

As the NSSO's 2011-12 data is dated, we use alternate methods to extrapolate more recent values of sugar consumption in the country. For this we use data on per capita income from GOI and data on income-demand elasticities from Kumar (2017). By adjusting

**Figure 5 Indian Sugar Consumption (grams/person/day) for 2004-05 and 2011-12**

Source Unit level NSSO 68th round consumption data, MOSPI, Kumar 2017

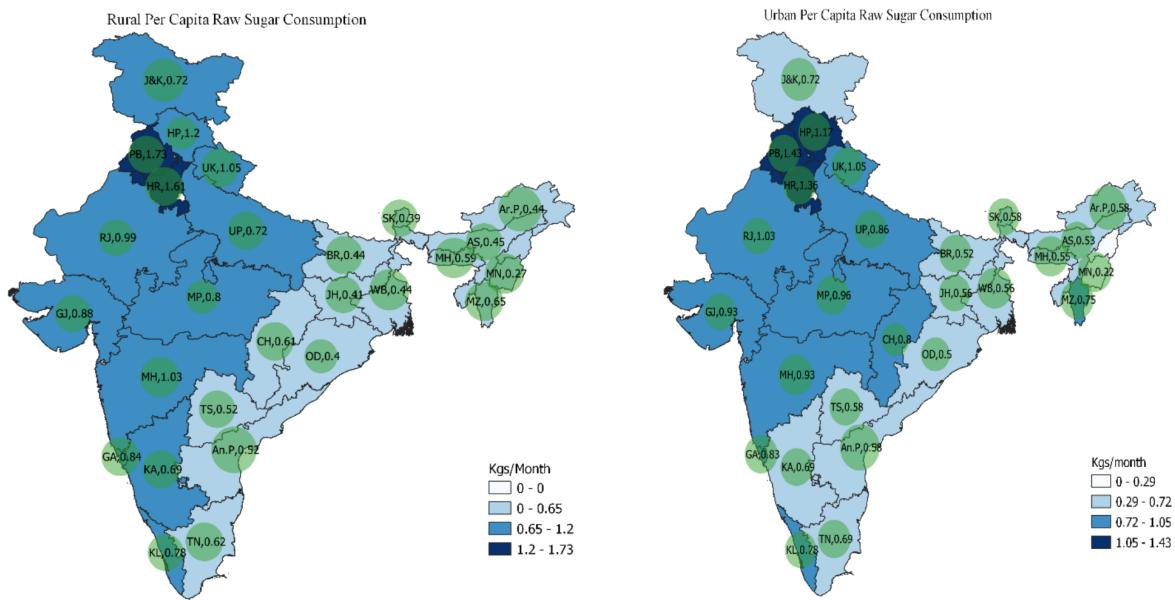


Figure 6 Per capita consumption of raw sugar (kg/month) 2011-12

Source Maps prepared by authors based on estimates from unit level NSSO 68th round consumption data.

Notes Sugar consumption is summation of sugar consumed from PDS and other sources. Union Territories not considered for this analysis. Do rich Indians consume more sugar?

the 2011-12 sugar consumption levels using income demand elasticities and annual change in overall per capita income in the country, ceteris paribus, we estimate sugar consumption levels for year 2020-21. As per the estimates, about 25 and 28.6 grams per person per day of sugar was consumed in rural and urban areas respectively in 2020-21. We plot these estimates in Figure 5.

Within India, there is a disparity between states based on the levels of sugar consumption. While several states such as Gujarat, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Uttarakhand,

and Uttar Pradesh observed above average sugar consumption levels, there were others like Telangana, Tamil Nadu, Andhra Pradesh, Odisha, Jharkhand, Bihar, West Bengal, Sikkim and the North-Eastern states where sugar consumption fell short of national average in both urban and rural areas (Figure 6).

Using the 2011-12 NSSO unit-level data, surveyed households were bifurcated into five expenditure (*proxy for income*) classes based on their level of monthly per capita expenditures (MPCE). It is found that sugar consumption increased with higher income/expenditure levels, in both rural and urban areas (Figure 7).

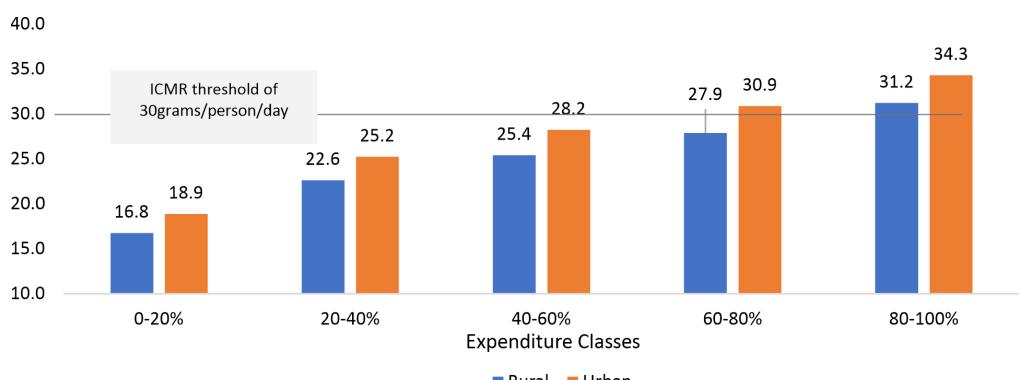


Figure 7 Expenditure class wise per capita sugar intake (2011-12)

Source Estimated by authors using unit level NSSO 68th round consumption data

It emerges that about 60 per cent households in rural areas and about 54 per cent households in urban areas consumed below ICMR's threshold of 30 grams per day threshold. Benchmarking against WHO's threshold, about 16 per cent population in rural areas and 15 per cent population in urban areas was consuming below 25 grams per day.

It is important to note that compared to other foods such dairy, meat, beverages, spices, etc., the income elasticity of sugar demand is low (Kumar, P 2017). It means that with increases in incomes, demand for other commodities is likely to grow much faster than sugar. However, the expenditure elasticity for sugar may differ across different expenditure groups.

Consumption of subsidized sugar from PDS

As per NSSO data, Indian consumers consume raw sugar sourced either from 'other sources' (i.e., the open market) or through GOI's Public Distribution System (PDS) (subsidized sugar). Under India's PDS, AAY families (or Antyodaya families which are categorized as *poorest of poor*) are provided 1 kg of sugar per family (DFPD). As per our calculations from NSSO 2011-12 data, per month consumption of sugar for a family of five² was 3.58 kgs in rural areas and 4.11 kgs in urban areas. Intuitively, in 2011-12, the percent of 1 kg PDS sugar supplied by sugar in total consumed sugar should

be 28 percent and 24 percent for rural and urban areas respectively.

However, calculations from 2011 NSSO survey data, show that at all-India level, in rural areas, 15 per cent of the total sugar consumption by individuals was from sugar sourced through PDS. For urban areas, this was lower, with only 10 per cent of sugar sourced from PDS for consumption. NSSO data also show that for states, the share of PDS sugar in total sugar consumption varies.

In rural areas, states such as Himachal Pradesh (54 per cent), Assam (67 per cent), Jammu & Kashmir (68 per cent), Tamil Nadu (70 per cent), Sikkim (70 per cent), Mizoram (71 per cent) and Tripura (89 per cent), depended on PDS for more than 50 per cent of sugar intake. In urban areas, overall, there was less dependence on PDS. Sikkim (62 per cent), Tamil Nadu (63 per cent), Jammu & Kashmir (64 per cent), Mizoram (65 per cent) and Tripura (83 per cent) depended on PDS for more than 50 per cent of sugar intake (Table 2).

Global trade of Indian sugar

India is not a regular exporter of sugar. Global trade is a function of, *inter alia*, domestic surpluses. Besides, as explained later, Indian sugar is not globally price competitive and therefore its exports have historically

Table 2 Proportion of PDS sugar in total consumed sugar (NSSO 2011-12)

Share	Rural	Urban
0-25%	Andhra Pradesh (24%), Karnataka (21%), Madhya Pradesh (17%), Kerala (14%), Gujarat (13%), Uttar Pradesh (11%), West Bengal (10%), Manipur (9%), Maharashtra (7%), Haryana (4%), Goa (3%), Rajasthan (2%), Bihar (2%), Nagaland (1%), Punjab (1%), Jharkhand (0.3%)	Chhattisgarh (11%), Karnataka (11%), Odisha (10%), Andhra Pradesh (10%), Kerala (9%), Madhya Pradesh (8%), West Bengal (6%), Manipur (5%), Uttar Pradesh (3%), Bihar (2%), Haryana (2%), Maharashtra (2%), Gujarat (2%), Rajasthan (2%), Jharkhand (1%), Goa (1%), Punjab (0.4%), Nagaland (0.3%)
25% to 50%	Arunachal Pradesh (40%), Uttarakhand (40%), Meghalaya (36%), Chhattisgarh (27%), Odisha (26%)	Arunachal Pradesh (38%), Assam (38%), Himachal Pradesh (35%), Uttarakhand (29%), Meghalaya (25%)
>50%	Tripura (89%), Mizoram (71%), Sikkim (70%), Tamil Nadu (70%), Jammu & Kashmir (68%), Assam (67%), Himachal Pradesh (54%)	Tripura (83%), Mizoram (65%), Jammu & Kashmir (64%), Tamil Nadu (63%), Sikkim (62%)

Source Unit level NSSO 68th round consumption data

Notes Number in parenthesis is the per cent share of PDS sugar in total sugar consumption

²As per Census 2011, average family size in India is five

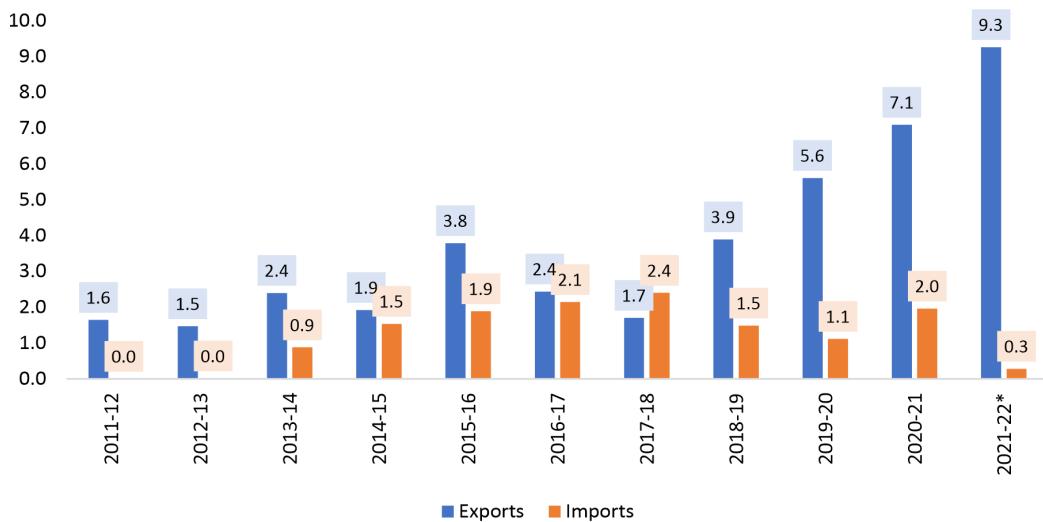


Figure 8 Sugar exports and imports from India (MMTs)

Source Ministry of Commerce and Industry

Notes Data is reported for both raw and refined sugar. *from April to February. The data here is for financial year.

been few and scattered. However, trends have changed around 2018-19. In TE 2019-20, India became the third largest sugar exporter and accounted for 7.3 per cent of global sugar exports following Brazil (38.2 per cent) and Thailand (16.3 per cent) (USDA 2022). A time series plot of Indian sugar exports and imports is given in Figure 8. India's major export destinations include Afganistan, Bangladesh, Djibouti, Iran, Indonesia, Jordan, Myanmar, Malaysia, Nepal, Qatar, Saudi Arab, Sri Lanka, Somalia, Sudan and UAE.

The good performance of Indian sugar exports since 2017-18 has largely been a function of growing support provided to sugar mills given by the government(s) (we explain this in later sections). The situtation in 2022 was, however, different. The Russian war on Ukraine resulted in huge spike in global prices of agricultural commodities, including that of sugar, which increased global competitiveness of Indian sugar. This led to a surge in Indian exports in 2021-22. However, fears of high domestic food inflation led GOI to cap sugar export at 10 MMTs for the year 2021-22 (GOI 2022). This was despite the country having a bumper sugar production of 35.5 MMT in 2021-22. This reflects the rather unpredictable character of Indian sugar trade policy. In terms of imports, there have been significant imports in 2016-17 (2.1 MMTS) and 2017-18 (2.4 MMTs). These were years of drought that impacted domestic production of sugarcane.

In the recent years, to meet the twin objectives of (i) helping financially unviable Indian sugar mills; and (ii) for promoting ethanol blending for fuel purposes, Indian government has been promoting diversion of cane towards ethanol production (we explain this in later sections). In 2019-20, 0.9 MMTs and in 2020-21, 2.2 MMTs of sugarcane was diverted towards ethanol production in the country (DFPD 2021).

Key health metrics of Indian population

Non-communicable diseases (NCDs) account for 61.8 per cent of the total deaths in India (Global Burden of Disease in Indian States 2016). The share of various causes of death under NCDs is given in Figure 9.

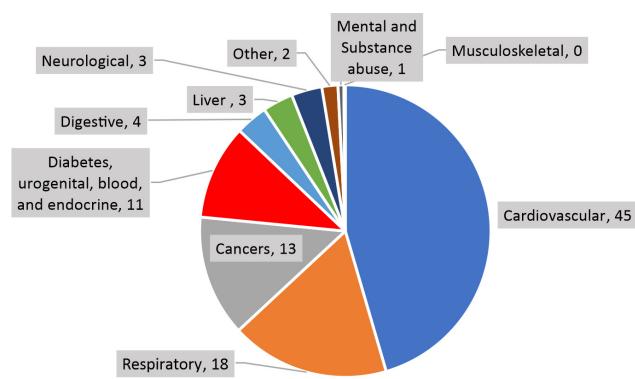


Figure 9 Death caused due to NCDs (2016)

Source Global Burden of Disease in Indian States 2016

Table 3 Health metrics of Indian population

Year	% Population with high blood sugar (>140 mg/dl)		% Population obese/overweight (BMI ≥ 25.0 kg/m ²)		% Population with diabetes	
	Women	Men	Women	Men	Women	Men
2005-06	NA	NA	12.6	9	2.7	2.9
2015-16	5.8	8	20.6	18.9	4.6	4.8
2019-20	6.1	7.3	24	22.9	NA	NA

Source National Family Health Survey (NFHS) (various years)

Diabetes, urogenital, blood and endocrine diseases accounted for 11 per cent of the total deaths due to NCDs.

Diabetes is a chronic condition marked by high concentration of glucose (sugar) in the blood (IDF 2021). Globally, 537 million people were diabetic in 2021. Out of this, India was home to 74.2 million diabetic people (about 14 per cent)³. It is estimated that by 2045, the incidence of diabetes in India is likely to go up to about 124.9 million (IDF 2021). It is important to note that consumption of added sugars is not directly related to incidence of diabetes. However, being overweight/obese increases the chances of a person becoming diabetic.

There are two types of diabetes, Type I and Type II. The Type I diabetes is not caused by sugar or lifestyle choices. However, overweight/obese people consuming more sugar are prone to Type II diabetes (IDF 2021). Consuming natural sugars under recommended thresholds is okay. However, consumption of added sugars, particularly when in excess, can cause health problems such as high blood pressure, inflammation, weight gain, diabetes, etc. (HMS 2022). Therefore, the Food Safety and Standards Authority of India (FSSAI) promotes intake of natural sugar present in fruits and vegetable and discourages consumption of simple sugars from sugar sweetened beverages (SSBs) and processed snacks with high added sugar contents (FSSAI 2017).

The Comprehensive National Nutritional Survey (CNNS 2019) finds that at all India level 1.3 per cent of children between 5 to 9 years and 1.1 per cent adolescents between 10 to 19 years were obese. CNNS

is a national representative survey conducted between 2016 and 2018 covering preschoolers, school-age children, and adolescents in both rural and urban areas of the country. The survey also found that the prevalence of diabetes is increasing in the country across age and social groups and diabetes is being increasingly diagnosed in children, adolescents, and younger adults. Reduced physical activity, obesity and poor diet are causing increase in diabetes (CNNS 2019).

National Family Health Survey (NFHS) 2019-21 data also suggests that both overweight/obesity and diabetes are increasing in India (Table 3). In 2005-06, 12.6 per cent women and 9 per cent men were overweight/obese. This increased to 20.6 per cent and 18.9 per cent in 2015-16 for women and men respectively. In 2019-21, it again increased, with 24 per cent women and 22.9 per cent being overweight/obese. Also, between 2005-06 and 2015-16, incidence of diabetes increased from 2.7 per cent to 4.6 per cent for women and 2.9 per cent to 4.8 per cent for men.

State-wise incidence of obesity/overweight

Using the NFHS state-level data, we map obesity/overweight for men and women in rural areas in Figure 10 and Figure 11. It appears, that obesity in women is highest in Punjab, Chandigarh in north and Kerala and Tamil Nadu in the south. In case of men, Tamil Nadu, Telangana and Jammu & Kashmir top the rank.

Overall, it appears that the southern state of Tamil Nadu has among the highest rates of obesity across gender and geography. Not surprisingly, poorer Indian states of Madhya Pradesh, Chhattisgarh, Jharkhand, Bihar rank lower on obesity.

³Estimates for adults between 20 and 79 years of age

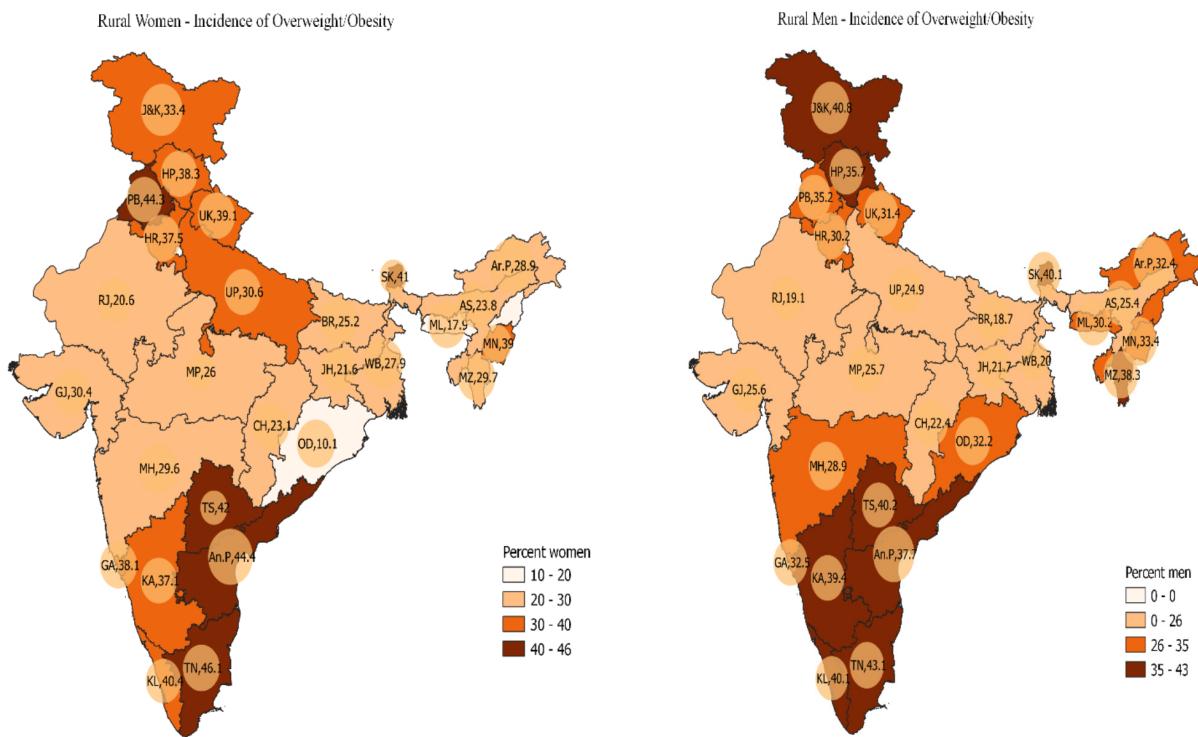


Figure 10 Incidence of overweight/obesity- Percent Women and Men (Rural 2019-21)

Source Maps created by authors based on NFHS 2019-21 data

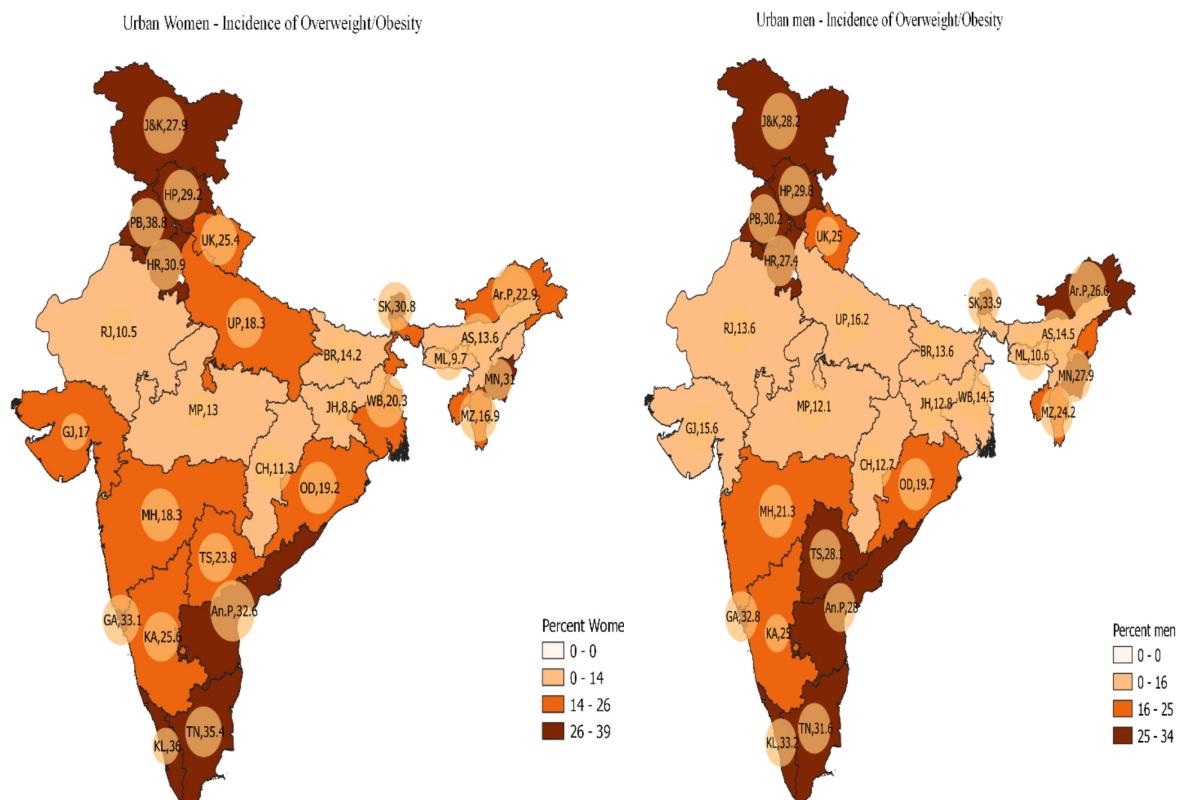


Figure 11 Incidence of overweight/obesity- Percent Women and Men (Urban 2019-21)

Source Maps created by authors based on NFHS 2019-21 data

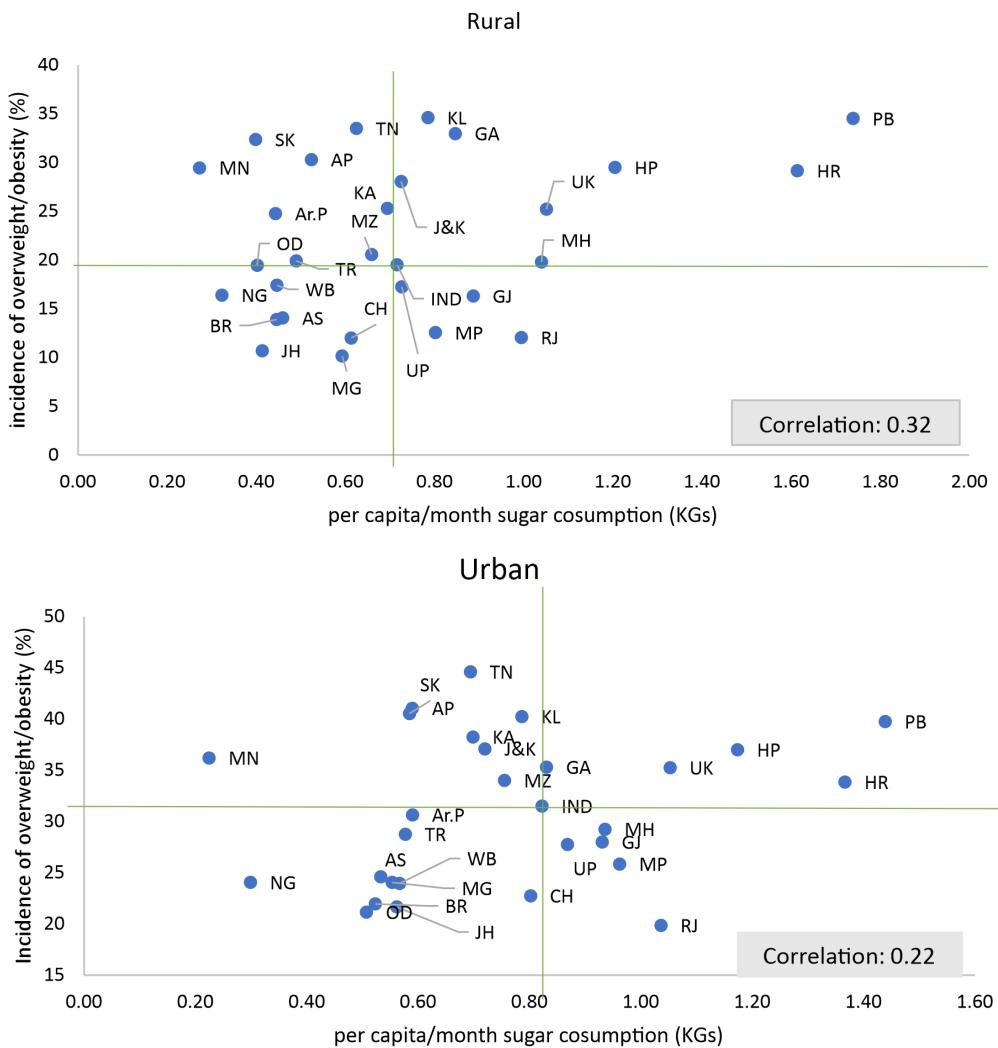


Figure 12 Per capita sugar consumption (kg/ month) and incidence of overweight/obesity (% population)
Source NSSO (2011-12) and NFHS (2019-21)

Mapping obesity with sugar consumption

Using the data on consumption of sugar from NSSO and obesity from NHFS, we find that both, per capita sugar consumption and incidence of overweight/obesity were higher in the northern and southern states. But is that a pattern? We check it via correlation charts (Figure 12).

In case of rural and urban areas, correlation between the level of per capita consumption and incidence of obesity is 0.32 and 0.22, respectively. This is not very high. Intuitively, this may be because of the high level of heterogeneity in consumption and health outcomes for groups within a specific state. Therefore, a more granular analysis is required. However, as stated before,

there is evidence suggesting that increased sugar consumption causes deterioration in health outcomes.

Stakeholders in Indian sugar value chain

The value chain of sugar is small and involves farmers, sugar mills and consumers (Figure 13). Most of the functions related to production, processing and marketing are regulated by the Government. All stakeholders are regulated in some way by either the central or the state governments, and some by both.

Farmers produce sugarcane which is used as raw material by the sugar mills for production of sugar. They receive support for producing cane in the form of various incentives and subsidies. There are multiple

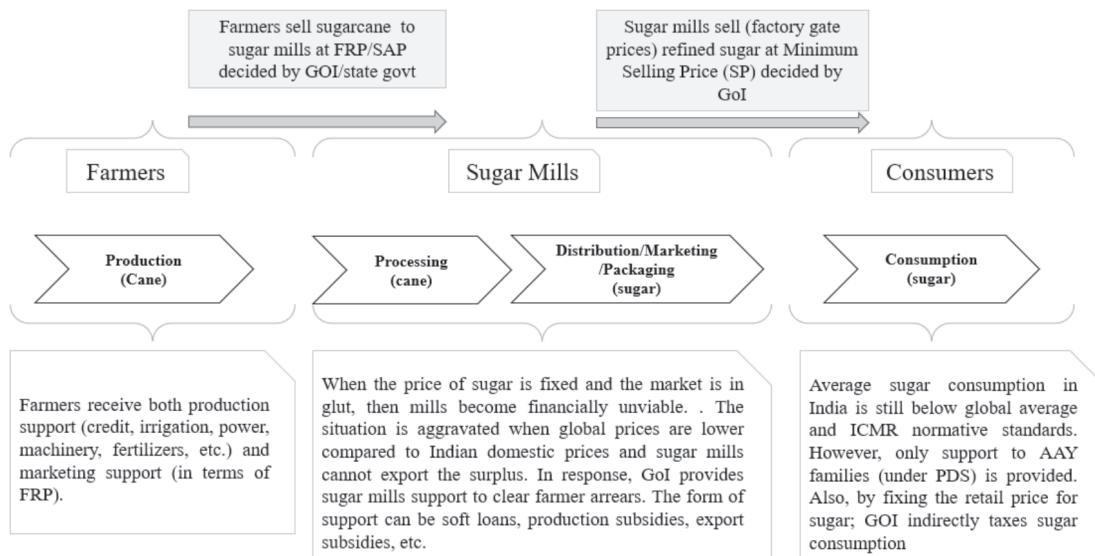


Figure 13 Life cycle of sugar in India

Source Compiled by authors

schemes of the Union and state governments that allow farmers to access subsidized inputs like credit, insurance, micro irrigation facilities, fertilizers, and machinery. In addition, farmers also receive price support for their cane in the form of Fair and Remunerative Prices (FRP). To increase support to cane farmers, some states declare a bonus over and above the FRP and declare a state advised price (SAP) that is generally higher than the FRP. To nudge farmers to produce, these prices are declared before the onset of the cropping season of the cane.

Sugar mills purchase cane from the farmers and pay them FRP (or SAP). Unlike the usual procurement process of grains under the minimum support price (MSP) regime, where government agencies physically procure and pay the farmers, for cane, the sugar mills procure and pay the price to farmer. Governments do not pay the FRP/SAP to the farmers. Mills undertake processing of cane and produce sugar, ethanol, and other by-products. As cost of input (cane) is fixed (as FRP or SAP), mills suffer when prices of its main product i.e., sugar fall. They need help from governments to tide-over financial stress. As one effort, GoI has started to peg ex-mill price of sugar to support the mills. The sugar from here is either consumed by individual or by industries for further value addition. There are several more aspects of policies influencing these stakeholders. These are detailed below.

Cane and sugar policy environment

Production related policies

Indian sugar industry is highly regulated with regulations ranging from cultivation of sugarcane to production of sugar and its by-products such as molasses and ethanol. These regulations are in the form of area reserved for sugarcane cultivation, minimum distance between sugar mills, price fixation, buffer stocking, sale of sugar by mills and trade policy of sugar for regulation of tariffs. Regulatory powers are exercised by both central and state governments.

The rationale behind regulating the Indian sugar industry is to ensure welfare of farmers, ensure return to the sugar industry and maintain adequate supply of sugar at a reasonable price to the consumer (NITI 2018, FAO 1997). In India, both cane and sugar are considered essential commodities under the Essential Commodity Act 1955 (ECA). ECA was enacted to ensure supply of essential commodities which are prone to hoarding and black marketing. This act gives powers to GoI to regulate production, supply/distribution, trade, and commerce of listed commodities (GoI 1955).

Exercising powers under the ECA, GoI notified the Sugar (Cane) Control Order (SCO) in 1966. SCO gives GoI the powers to regulate production of sugar, put restrictions on sale of sugarcane by farmers, issue

directions to producers and dealers, regulate movement of sugarcane, fix sugarcane prices and allot quotas for marketing of sugar, and provide directions to supply sugar etc. (GOI 1966). With amendments to SCO in 2009, 2016 and twice in 2018 and 2019, GOI now regulates production of molasses as well as the ethanol produced from cane juice and sugar.

In the section below, we list major policies in this regard.

Pricing of sugarcane

To deliver remunerative prices to cane farmers, GOI declares minimum price for sugarcane. Before 2009, these prices were referred to as statutory minimum prices (SMP). Post 2009, GOI replaced SMP with the Fair and Remunerative Prices (FRP). In case of wheat and paddy, the Government not only declares the MSP, but also procures the same for distribution under the PDS. In case of cane, the GOI only declares the FRP and does not undertake any physical procurement. The FRP is to be paid by the sugar mills to the farmers.

FRP is decided by the central government based on recommendations of the Commission of Agricultural Cost and Prices (CACP). It is calculated based on factors like the cost of production, return to producers from alternate crops, availability of sugar to consumer at fair prices, selling prices, recovery rates of sugarcane, and margins of producers after accounting for risks (DFPD). Sugar mills are mandated to pay at least this price to sugarcane growers. These payments have to be made to farmers within 14 days of purchasing cane by sugar mills.

There are three important aspects about cane support prices:

- i. Effective FRP differs from FRP: Sugar recovery rates from cane differ between states and sometimes even within states. Consequently, FRP payments, which are linked to recovery rates of sugar from sugarcane, differ. Usually, FRP is declared based on an average recovery rate and there is a rate of adjustment provided for estimating FRP for varying rates. For example, before 2018-19, FRP was linked to an average recovery rate of 9.5 percent. However, due to improved yields and quality of cane, the average recovery rate has increased to 10 per cent since 2018-19. For 2021-22 season, for every 0.1 percentage point increase in recovery rates, there is an addition of Rs. 2.90 per quintal to the FRP. The adjusted FRP amount is referred to as the effective FRP.
- ii. Some state governments announce State Advisory prices (SAP) which are higher than FRP. In 2022, Punjab, Haryana, Uttarakhand, and Uttar Pradesh declared SAP which was higher than FRP. Details of SAP notified by states are given in Figure 14. Among the states declaring SAP, highest SAP is reported by Haryana (in 2019-20, Rs 340, Rs 335 and Rs 335 per quintal for early, mid, and late varieties of sugarcane respectively). In 2019-20, the highest gap between FRP and SAP for early variety was in Haryana (Rs. 65 per quintal), followed by Uttar Pradesh (Rs. 50 per quintal). Two major sugar producing states, Maharashtra,

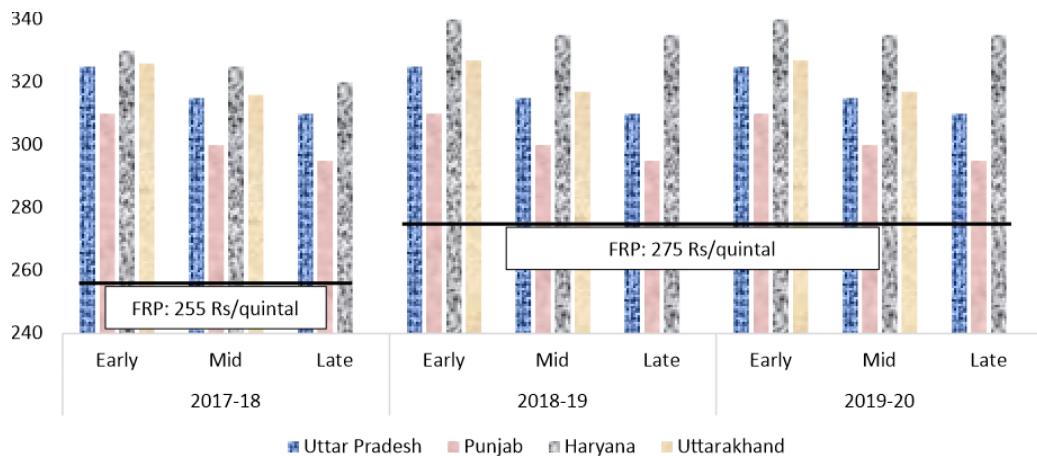


Figure 14 State Advised Prices (SAP) for different varieties

Source Commission on Agricultural Costs and Prices (CACP)

and Karnataka, do not declare SAPs. It is important to note that the SAP is not linked to recovery rates of sugar from sugarcane, and it is paid to farmers irrespective of recovery rate of sugar from sugarcane.

- iii. Early variety of cane gets the highest SAP: In UP, the SAP is notified for three sugarcane varieties, i.e., early variety, mid variety, and late variety. Highest SAP is issued for the early variety.

Cane reservation area

As per SCO 1966, the GOI reserves the area from which the sugar mills can purchase sugarcane. It means that the mills are mandated to purchase sugarcane from farmers growing in the cane reservation area only and the farmers are obligated to sell to the mills in the reserved area. The rationale behind this policy is to ensure adequate supply of sugarcane to the sugar mills. Another objective is to reduce the purchase cost of sugarcane (by minimizing transportation cost) so that the farmers are ensured remunerative price for sugarcane.

Minimum distance criteria

As per SCO, the minimum distance between two mills is fixed at 15 kilometers. Following on the cane reservation policy, this regulation is to ensure ample availability for sugarcane to sugar mills. While all the above policies were meant for cane producers and mills, we next list policies/programs which affect sugar.

Minimum selling price (SP) of sugar

India has been producing surplus sugar for the last five years since 2017-18. To help the sugar industry/mills fight depressed prices due to this surplus production and to protect the interest of the farmers whom the mills had to pay, the GOI in 2018 amended the SCO. It introduced the concept of minimum Sale Price (SP) of sugar (CACP). SP was derived from FRP, and the minimum conversion cost incurred by the mills to produce sugar. In June 2018, the government fixed the prices of white/refined sugar at Rs 29 per kg. This was increased Rs 31 per kg in February 2019. The SP has not been changed since then and it continues to be at Rs. 31 per kg. In 2022 sugar retail prices were above the SP.

Buffer stocks of sugar

In addition to setting a minimum price for sugar, GOI has supported the cane farmers and the sugar mills via its buffer stock scheme. In years of surplus and depressed sugar prices, mills are unable to sell sugar in the open market at viable prices and thus pay the cane farmers. In such years, sugar mills are advised to maintain buffer stock of sugar on behalf of GOI, which in turn reimburses the cost of maintenance of these stocks. The reimbursement is called the 'buffer subsidy' which is paid quarterly, directly to the farmers relative to their cane dues and the rest is credited the sugar mills (DFPD).

Trade policy for sugar

Export and import of sugar is regulated by customs duties, export quotas and export subsidies (DFPD). In years of large surplus of sugar, GOI fixes export targets for liquidating excess sugar in export markets. These quotas are called MIEQ i.e., Minimum Indicative Export Quotas. MIEQs are based on average sugar production in last two seasons and the current season (DFPD). In 2017-18, 2018-19, GOI announced MIEQ of 2 MMTs and 5 MMTs respectively (DFPD).

GOI has also announced export subsidies to facilitate export of sugar. These subsidies are in form of marketing assistance, including freight charges, upgrading and other processing costs, etc. In 2019-20 season, under the export subsidy scheme GOI announced a Maximum Admissible Export Quota (MAEQ) of 6 MMTs for sugar mills. To receive assistance under the subsidy scheme, mills had to at least export 50 percent of MAEQ allocations (GOI 2019).

These quotas are fixed in order to ensure liquidity of the sugar mills, ensuring timely cane price payments and ensuring domestic availability of sugar in the country (Niti Aayog 2021).

In year 2021-22, GOI has put restrictions on sugar export. This, as mentioned before, is motivated to curtail any domestic price pressures building up in sugar. Despite a bumper sugar production of 35.5 MMTs in the current year, GOI capped export of sugar.

Ethanol and other by products

The government in 2003 initiated the ethanol blending programme (EBP). Under the scheme, the government

supports production and marketing of ethanol in the country. Exercising powers under the sugar control order, the government can control the production of ethanol from sugarcane, sugar, and sugar syrups. GOI also regulates and fixes the price for ethanol derived from sugar and its by-products. For 2021-22 season, the ex-mill prices fixed by the GOI range between Rs. 46.66 per liter to Rs. 59.08 per liter for ethanol derived from C-heavy and B-heavy molasses, respectively. The ex-mill price for ethanol derived from 100 percent sugarcane juice/sugar/sugar syrup is Rs. 63.45 per liter (DFPD). In addition, the government also provides support (in terms of soft loans and assistance) to sugar mills and distilleries for increasing capacity of ethanol production in the country with, among other things, to support timely cane payment to farmers (DFPD).

As per MOPNG, 84 per cent of the ethanol used for blending with fuel in India for in the ethanol supply year 2021-22 came from sugarcane and its by-products. By 2025-26, the target is that 55 per cent of total ethanol demand for fuel blending would be fulfilled by the sugar industry (NITI Aayog 2021).

Consumption related policies

Distribution of sugar under PDS to AAY families

To support the sugar consumption needs of the poorest-of-poor families (referred to as the Antyodaya households), GOI provides them with subsidized sugar under the Public Distribution System (PDS). As per the National Food Security Act (NFS) 2013, AAY families are provided 1 kg per month per household. The central government provides a fixed subsidy of Rs. 18.5/kg to states for open market procurement of sugar.

FSSAI regulations related to processing, packaging/ labelling regulations

- i. Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011: specify the quality standards for various products such as milk & related products, drinking water, meat and its products.
- ii. Food Safety and Standards (Packaging and Labelling) Regulations, 2011: provide guidelines for product packaging and labelling including sugar. After these regulations, it is mandatory to

display nutritional information (including added sugars) on the packaging of processed products.

- iii. Food Safety and Standards (Advertising and Claims) Regulations, 2018: the regulations make businesses accountable for the claims that they may be advertising for certain food products. These claims are categorized under various heads such as 'nutritional claims', 'non-addition claims', claims related to dietary guidelines, etc.
- iv. Food Safety and Standards (Safe food and balanced diets for children in school) Regulations, 2020: The regulation make way for clear bifurcation on health and non-healthy foods for school children.

Health related policies

To address the issue of increasing overweight/obesity and diabetes in the country, GOI has initiated various measures.

National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS)

In 2010, in order to prevent and control NCDs, GOI initiated NPCDCS. The objective of this programme is to create infrastructure, develops human resource, promote health and early diagnosis and support management NCDs. NPCDCS follows a strategy of early diagnosis, treatment and follow-up through NCD clinics. Under the National Health Policy 2017, a target of 25 per cent decrease in premature deaths by 2025 due to cardiovascular diseases, cancer, diabetes and chronic respiratory diseases has been set (NHP 2017).

Rashtriya Kishore Swasthaya Karyakram (RKS)

In 2014, the GOI launched RKS for adolescents between 10 to 19 years. Under the scheme, a national adolescent health strategy has been made with the objective to improve nutrition, sexual & reproductive health, mental health and prevent injuries and substance misuse of the 234 million adolescents in the country (National Health Portal).

Working group to address consumption of food high in fat, salt and sugar

To address the increasing risk of NCDs among children due to increasing incidence of obesity/overweight, the

Ministry of Women and Child Development has set up a working group to address the high fat, salt, and sugar (FSS) diets of the children in 2015. The recommendation of the group ranges from a ban on HFSS sale in school canteens, setting up of School Canteen Management Committees, ensuring labelling of readable sizes, incorporation of warning for specific diseases for infants, children, and pregnant women, among others. (WCD 2015).

Ongoing policy dialogues

Various committees/institutions have recommended (Rangarajan committee, CACP, NITI Aayog) the deregulation of the sugar sector. This includes removing the cane reservation area, minimum distance criteria for sugar mills, levy sugar, regulated release mechanism. Only levy sugar has been dispensed with. The rest have not yet been adopted by most of the state governments (NITI Aayog 2021). CACP and NITI Aayog are also advocating discontinuation of State Advised Prices of sugarcane.

To tackle the increasing incidence of overweight and obesity in India, the Government is looking at country specific evidence to understand the type of policy interventions that can be opted. NITI Aayog has suggested front-of-pack labelling, marketing and advertising of High-FSS foods and taxation of foods with high FSS contents.

Level of support to cane and sugar industry

After highlighting the policies which are used to support the cane farmers and sugar mills, we move to an analysis of the union/state (in this case Uttar Pradesh) budgets to understand ways in which the governments support these two stakeholders. Using the annual budget statements of the union/state government, we present an analysis for seven years, 2015-16 through 2022-23.

Union Government's support to sugar industry

Budgetary allocations to the sugar industry are made under GOI's Ministry of Consumer Affairs and Food and Department of Food and Public Distribution (DFPD). Since 2015-16, the total departmental allocations and the share of sugar in total allocations are given in Figure 15.

GOI uses multiple conduits for providing support to the sugar industry. Based on the objective of the budgetary provision, the support to the sector can be broadly segregated under two heads:

- Budgetary support for development of infrastructure, increasing capacity of sugar mills and distilleries, co-generation plants, fulfilling administrative expenses of loss-making sugar mills, etc. Schemes financed from the Sugar Development Fund (SDF), schemes for the

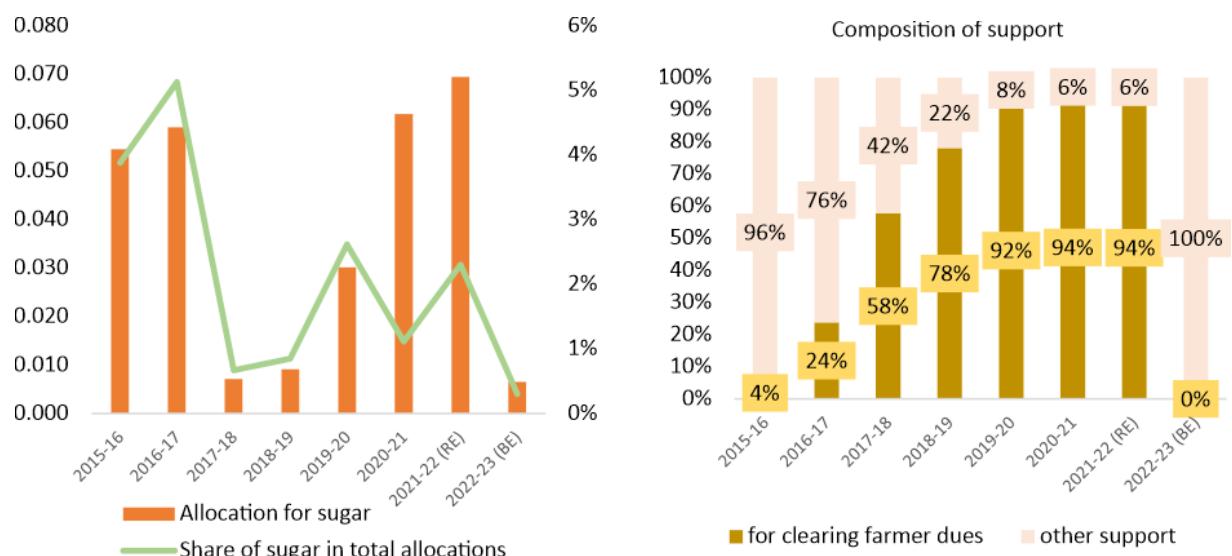


Figure 15 Allocations to sugar industry and composition of support

Source GOI budget documents

development of sugar industries, financial assistance for ethanol production are under this set of budgetary support; and

- ii. Budgetary support provided to support cane price payments by sugar mills to the farmers. This includes schemes providing assistance, or soft loans to sugar mills and export subsidies are under these set of budgetary support.

Sometimes, there is an overlap between these two, otherwise distinct sets of objectives. For example, in the case of ethanol, the GOI supports sugar mills for producing ethanol, but sometimes, this would be done to provide an additional source of revenue for the mills, so they can pay the arrears of sugar cane to the farmers. From right panel in Figure 15, it emerges that within the overall budget allocated for sugar, more than 90 per cent (since 2019-20) has gone as loans/ assistance to mills for clearing arrears of the farmers. The situation is more vivid since 2017-18. However, in two years prior to that, most of the sugar budget went towards betterment of the sugar industry, paying for sugar under the public distribution system (PDS) and the Sugar Development Fund (SDF). While allocations under SDF, schemes for development of sugar industries and the PDS have been falling, that of assistance for settling farmer arrears have been rising.

In 2022-23, the budget for sugar industries is exceptionally low, due to the high global prices which have been used by sugar mills to export sugar.

Uttar Pradesh Government support to sugar industry

Uttar Pradesh (UP) is an important sugar producing Indian state. To support cane farmers, it declares SAP

that the sugar mills have to pay the farmers. SAP is higher than FRP. While FRP varies with the yield and sugar conversion power of cane, SAP is fixed. In Uttar Pradesh, SAP remained constant between 2017-18 and 2020-21. Due to this, the gap between effective FRP and SAP has been falling and the effective FRP was higher than the SAP in 2019-20 and 2020-21. It means that if the UP did not have an SAP policy, the cane farmers could have realized better prices under GOI's FRP mechanism. (Figure 16).

In UP, budgetary allocations to sugar industry are made to two departments. These are mentioned below.

- i. Sugarcane Development Department (Sugar Industry) (CDD-SI): under this head, budgetary allocations are made to sugar industry for a variety of purposes ranging from allocation for capital investments crop farming, research & development, loans to mills for increasing ethanol capacity and loans/assistance to mills for clearing farmer dues.
- ii. Sugarcane Development Department (Sugarcane) (CDD-S): under this head, all the administrative expenses are budgeted.

Majority of the allocations for sugar industry are made under the CDD-SI department (Figure 17). Going forward we look at CDD-SI department for support provided to the sugar industry in the state.

The budgetary allocation and composition of those allocation are mentioned in the Figure 18 below. Between 2016-17 and 2022-23, on average the total budget of the department is Rs. 1641 crores. However, the budget allocation drastically increased in FY 2018-

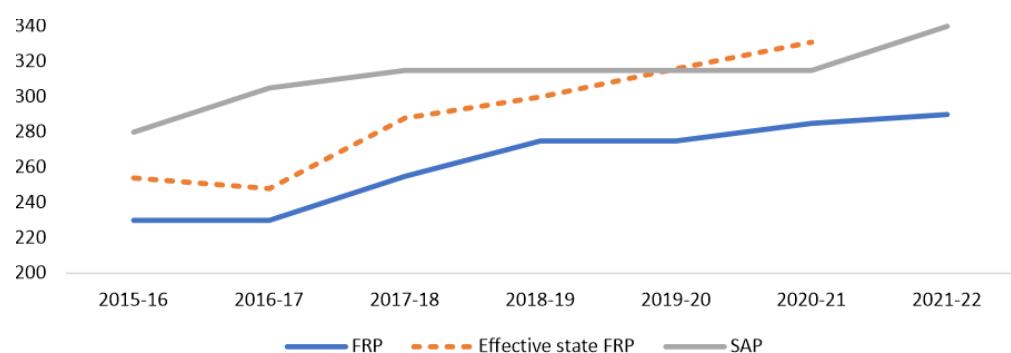


Figure 16 Effective FRP, FRP and SAP: Uttar Pradesh (Rs. /quintal)

Source CACP

Note SAP for common variety. Effective FRP for 2019-20 and 2020-21 has been taken from ISMA and is based on recovery rates which include the sugar equivalent diverted to sugarcane juice, syrup, sugar, or B-heavy molasses.

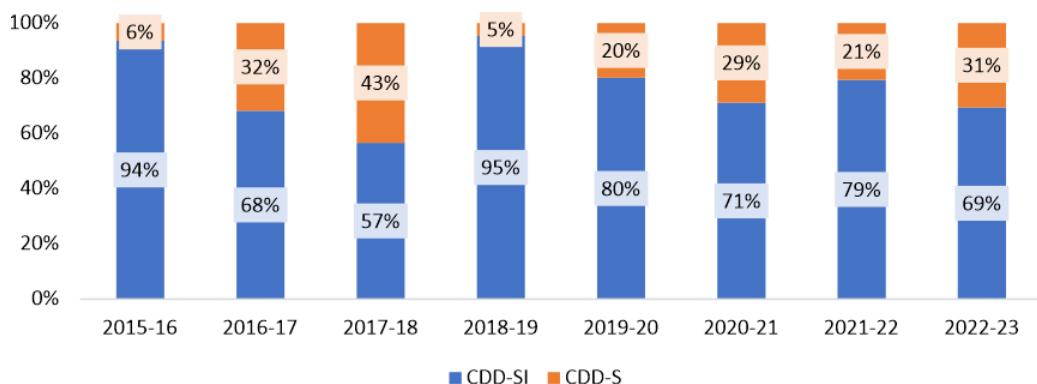


Figure 17 Share of budgetary allocation for CDD-S and CDD-SI

Source UP budget documents

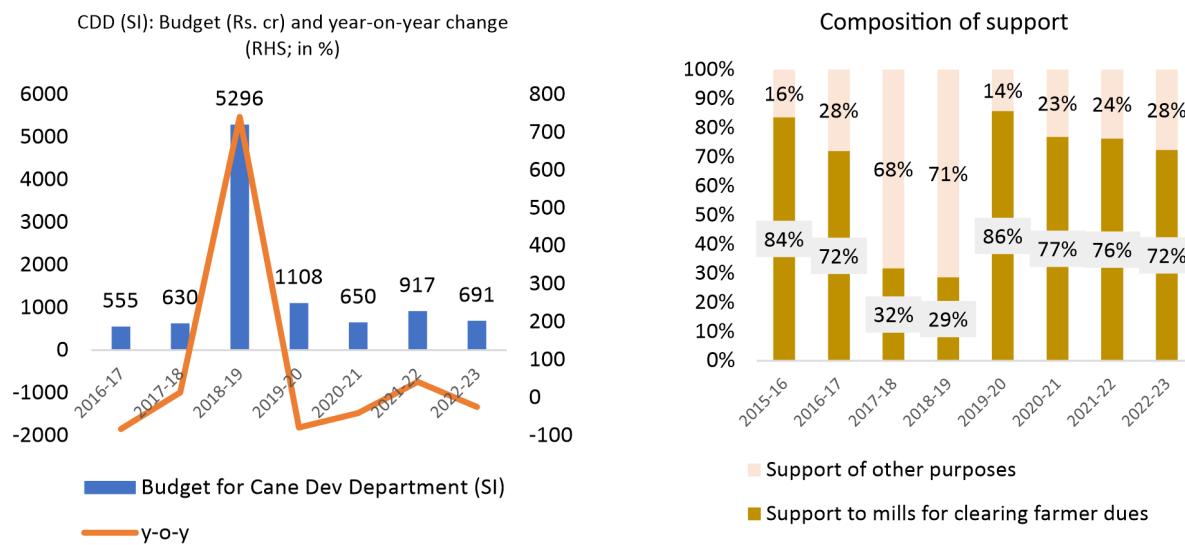


Figure 18 CDD-SI: Budget and composition of support

Source UP budget documents

19 to about Rs. 5,296 crores. The allocation under the department peaked in 2018-19 and 2019-20 and has been decreasing since then. When looked at the composition of this budgetary allocation, it is observed that on average, above 60 per cent of the budgetary allocations are in form of loans and assistance/subsidies for paying the cane dues of farmers. In 2015-16, 84 per cent of the total budget allocation was given as support to sugar mills for clearing farmer dues. In this year Rs. 2130 crore assistance and Rs. 617 crores of loans were provided to sugar mills. The share of budget for clearing farmer due decreased to 29 per cent in 2018-19 (though the absolute allocation for clearing farmer dues increased, the effect of which wasn't seen as the total budget of the department increased too). It

then again increased to 86 per cent in 2019-20 and is currently at 72 per cent in FY 2022-23. In majority of the years since 2015-16, budgetary support to mills was provided as loans.

On the other hand, on average 34 per cent of the allocations to CDD-SI are made for R&D, capital investments purposes. The share increased to 68 per cent and 71 per cent in FY 2017-18 and FY 2018-19 respectively and has decrease to pre-2017-18 levels since then.

We also found that budgetary support for clearing farmer dues is correlated with price of sugar in global markets. We explore this in the section below.

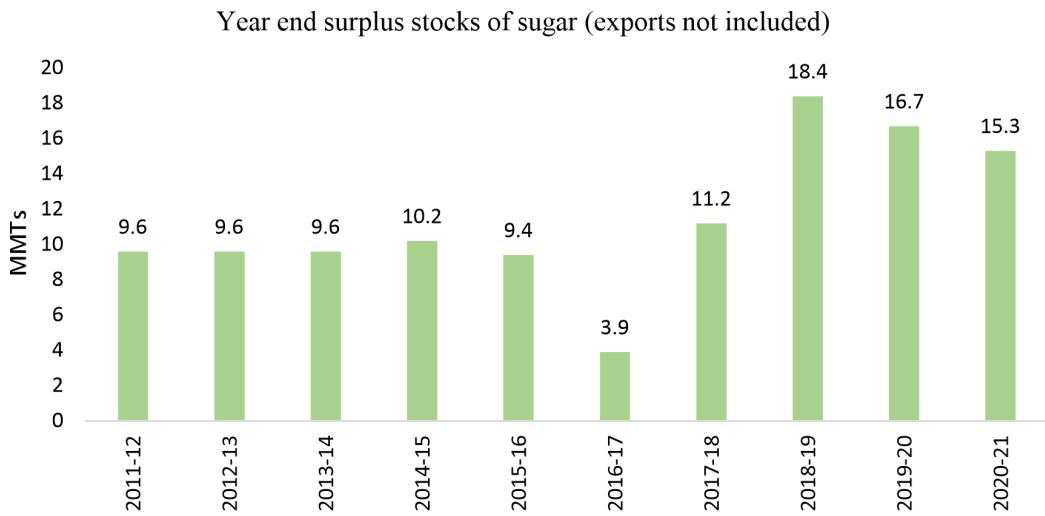


Figure 19 Domestic surplus of sugar

Source ISMA

Connecting the dots

Is it true that Indian exports are a function of domestic surpluses? And despite high and rising domestic prices of sugar, how could Indian mills export large quantities of sugar? We explore answers to these questions below.

Detailed below is the change in sugar surplus in India since 2011-12 (Figure 19). Surplus/deficit are summation of opening stocks, production, and imports net of domestic consumption. Data is sourced from ISMA. It is evident that surplus of sugar has been rising in India, especially in 2018-19, 2019-20 and 2020-21. In addition, as per data on level of consumption and production of sugar in India from OECD, in 2019 and

2020, India produced 8.6 MMTs and 1.6 MMTs of sugar above the estimated level of consumption in the country. OECD data states that between 2011 and 2020, in most years, India reported surplus production of sugar.

As we see below, in the years of high surpluses, exports are high too (Figure 20).

Interestingly, between 2017-18 and 2020-21, Indian sugar prices (ex-mill prices) were much higher than global counterpart prices (EU refined sugar fob prices proxied by their unit value of exports) (Figure 21).

The data suggests that Indian ex-mill prices were lower than EU-28 export prices between FY 2011-12 and

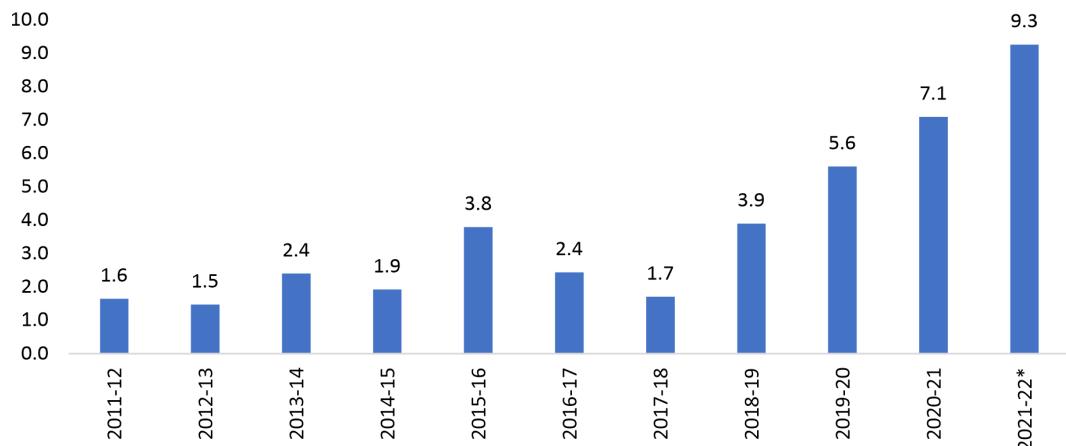


Figure 20 Export of Indian sugar (Refined sugar) (MMTs)

Source Ministry of Commerce and Industry (GOI)

Note *from April to Feb

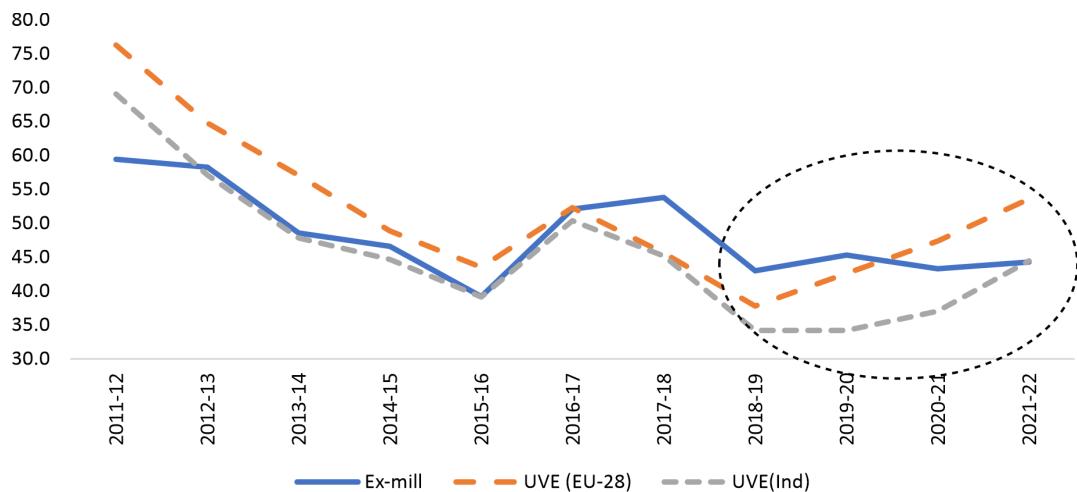


Figure 21 Trends in sugar prices (\$ per quintal)

Source ISMA, Ministry of Commerce and Industry, Department of Consumer Affairs (GOI), UN-Comtrade. Note: EU-28 export prices are not adjusted for domestic transportation and marketing costs of sugar and hence represent FOB EU prices.

2016-17. Between 2017-18 and 2019-20, Indian ex-mill prices were higher than global prices. This means, that in these years, Indian sugar was not price competitive in global markets. When Indian export prices (unit value of exports) are considered, we find that till 2016-17, Indian export prices were largely in sync with ex-mill prices. However, since 2017-18 (till 2021-22), Indian exports prices were lower despite relatively high domestic ex-mill prices.

Mapping these years with budgetary support (focusing on the time period between 2015-16 and 2021-22) provides interesting insights (Figure 22). It appears that the quantum of total budgetary support to sugar and

cane industry increased post 2018-19 till 2021-22. Intuitively, it appears that Indian sugar exports have been increasing despite the mismatch in ex-mill (domestic) and Indian sugar export prices due to assistance from GOI.

Benefits and costs associated with cane and sugar industry

Till now, we have found that a) the country is producing more sugar than is required to meet its current consumption requirements; b) average Indian consumption of sugar is below the global averages; and c) the industry is regulated heavily on both



Figure 22 Budgetary support to cane and sugar industry (Rs. crore)

Source GOI budget documents

production and marketing sides of the value chains, which have distortionary impacts on the sugar markets.

Building on these results, in this section we quantify benefits of production of cane and sugar. This is followed by an examination of the associated costs of cane and sugar production and consumption on health, environment and people involved in the sugar value chains.

We identify the following benefits and costs.

Benefits

i. High value of output for cane and sugar and employment opportunities

Ministry of Statistics and Programme Implementation (MoSPI) provides estimates for the value of output generated from various agricultural commodities. Data in this regard is available till 2017-18. Data averaged for the triennium ending 2017-18, suggest that cane production in the country was valued at Rs. 82,022 crores (approximately \$12.7 billion). This was about 0.17 percent of the total gross domestic product (GDP) of the country. With regards to the value of production for raw sugar⁴, it was found that sugar production was valued at Rs. 1,02,933 crores (approximately \$15.9 billion⁵).

In addition to this, sugarcane and sugar industry provides employment to a large proportion of country's workforce. Data from CACP for year 2020-21 suggests that 50.5 million individuals are employed either in cane or sugar production. Out of these, 50 million are farmers and the rest 0.5 million are directly employed by the sugar mills. When mapped with the total workforce as per Census, 2011 comes out to be 10.64 per cent of the total workforce, suggesting that a big chunk of people working in the economy are dependent on the sugar industry.

ii. High profit margins for cane producers

Department of Economics and Statistics (DES), GOI provides data on cost of cultivation (CoC) and value of the produce. This helps us calculate

the profitability of for major crops. Latest data in this regard is available till 2018-19. DES provides CoC estimates using various methods. These are:

- a. A2 cost includes the actual paid out cost incurred by cultivators on inputs, hired labor, etc.
- b. A2 cost + Family labor (FL): A2 cost added with the imputed cost of unpaid family labor. CACP uses this cost, among other things to calculate the minimum level of price support to identified commodities. We make use of this for further analysis.
- c. C2 cost: costs including imputed rent and interest on owned land and capital.

For calculating profitability, we look at A2+FL cost. A2 cost looks at the paid-out cost by the farmers. As the cultivation of sugarcane and other considered crops (wheat and rice) for the analysis are labor intensive, we also look at the imputed value of family labor in the total cost of cultivation. The top four sugarcane producing states, i.e., Uttar Pradesh (UP), Maharashtra (MH), Karnataka (KA) and Bihar (BR) are considered for this analysis. We find that sugarcane profitability is higher than paddy and wheat profitability (Figure 23). Profitability is revenue divided by CoC expressed in percentage terms. For sugarcane, profitability ranged between 74 per cent to 302 per cent for the selected states. The highest profitability was observed in Karnataka (302 per cent), followed by Uttar Pradesh (199 per cent), Bihar (167 per cent) and Maharashtra (74 per cent). In all the four states, profitability of paddy and wheat was way lower when compared to sugarcane.

- iii. Benefits of the by-products: Apart from the regular use of cane by-products in making bio-gas, paper pulp etc., it is ethanol that is delivering benefits to all in the value chain. From reducing, *albeit* marginally, country's crude oil dependence, using ethanol in fuel is also reducing vehicular emissions. But is cane production and diversion to ethanol net carbon-reducing? Is the net carbon footprint of cane negative? It needs deeper research.

⁴Value of output for raw sugar is calculated by multiplying total production with domestic wholesale prices

⁵Monthly exchange rate from April, 2015 to March, 2018 was simple averaged

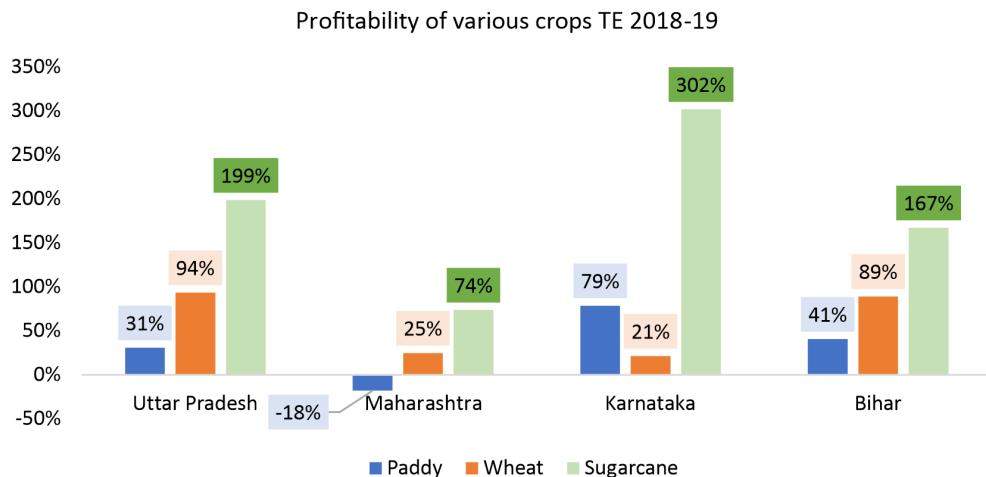


Figure 23 Profitability of major crops

Source Department of Economics and Statistics (GOI)

Costs

i. High cost of cultivation (COC)

Data averaged for triennium ending (TE) 2018-19 suggests that A2+FL CoC for sugarcane is higher in all the four states. Maharashtra had the highest CoC (Rs. 1,35,216/ha), followed by Bihar (Rs. 71,013/ha), Uttar Pradesh (Rs. 66,162/ha) and Karnataka (Rs. 58,760/ha). Whereas CoC for wheat and paddy were relatively lower. It is interesting to note that, in Maharashtra and Bihar, combined CoC for paddy and wheat was lower than CoC for sugarcane (Figure 24).

If economic costs associated with of excessive water use is added, this CoC will be even higher.

The annual per capita availability of water has been decreasing constantly in India. It decreased from 5177 cubic meters in 1955 to 1544 cubic meters in 2011 (CWC 2015). Also, 78 per cent of all water resources in India are used by agriculture. (CWC 2014). Sugarcane cultivation is highly water intensive. For instance, in Maharashtra, only 4 per cent area is under sugarcane cultivation but it uses 64 per cent of the total irrigation water available (Gulati and Mohan 2018).

A measure of water use is the Physical Water Productivity (PWP). PWP is calculated using Total Consumptive Water Use (TCWU) and total production and expressed as the ratio of agriculture output to amount of water used. The global average

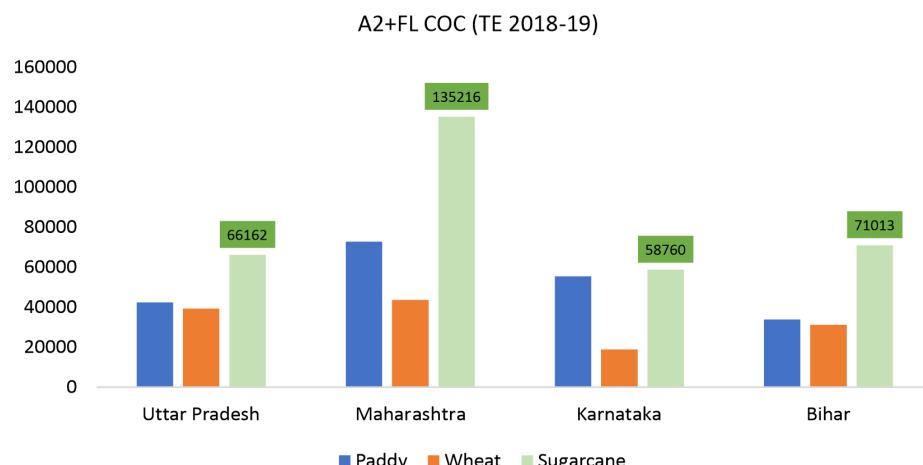


Figure 24 Cost of Cultivation for major crops (Rs. per hectare)

Source Department of Economics and Statistics (GOI)

PWP for sugarcane was found to be 5.8 kg per cubic meter (Sharma et al. 2018). This means that 5.8 kg of sugarcane can be grown with 1 cubic meter of water. In India, PWP was estimated to be 5.2 kg per cubic meter. PWP varied between 0.6 to 22.4 kg per cubic meter in India (Sharma et.al 2018). Land productivity and water productivity was also not in sync for several states such as Tamil Nadu, Haryana, Andhra Pradesh, Madhya Pradesh, etc. Meaning higher water use followed by low productivity. Efforts need to be made to increase water efficiency by adjusting price of power and irrigation water. Also, aligning cropping patterns with water endowments of the regions is crucial (Sharma et.al. 2018).

ii. Costs associated with deteriorating public health

As seen in the sections above, incidence of obesity/overweight is rising in the country. Even though sugar is not directly connected to diabetes, obesity/overweight can increase the chances of being Type II diabetic. It is estimated that in India, economic cost of overweight and obesity was \$23 billion, which is expected to increase to \$479 billion in 2060 (WOF 2021). Non-communicable diseases account for 61.8 percent of the total deaths in India (GBD 2021). Where diabetes (part of NCDs) ranked seventh in causes of deaths with a rate of 23 deaths per 100000 individuals (IHNS 2016). Diabetes accounted for DALYs (836/100000) with mean Out of Pocket Expenditure

(OOPE) for hospitalization Rs. 18,091 (\$235).

iii. Transfer of benefits from consumers and taxpayers to sugar producers

Support for a single commodity is referred as the Single Commodity Transfer (SCT) as per OECD's Producer Support Estimate (PSE) manual. SCT measure the annual monetary transfers from consumers and taxpayers to agricultural producers of a commodity. A positive SCT implies positive support to the sugarcane farmers. The OECD provides estimates of SCT for various commodities. For India, SCT data is available from 2000 to 2020 (Figure 25). The sugar SCT is positive for majority of the years. The SCT support has increased post 2016 indicating to higher support reaching cane farmers. This is in line with our observations made on the increase in support following increase in domestic surpluses in previous section.

iv. Water pollution by mills

All major divisions of the sugar mill such as processing plants, cooling towers, sugar manufacturing plant produce waste. The waste materials include solid wastes, depleted water oxygen level contents, molasses, etc. (Ranjan et.al 2021). Also sugar industries are one of the biggest polluters of fresh water. In India, sugar industry produces about 1000 litres of wastewater for every kilogram of crushed sugarcane (Sahu and Chaudhuri 2015). Effluents discharged from sugar

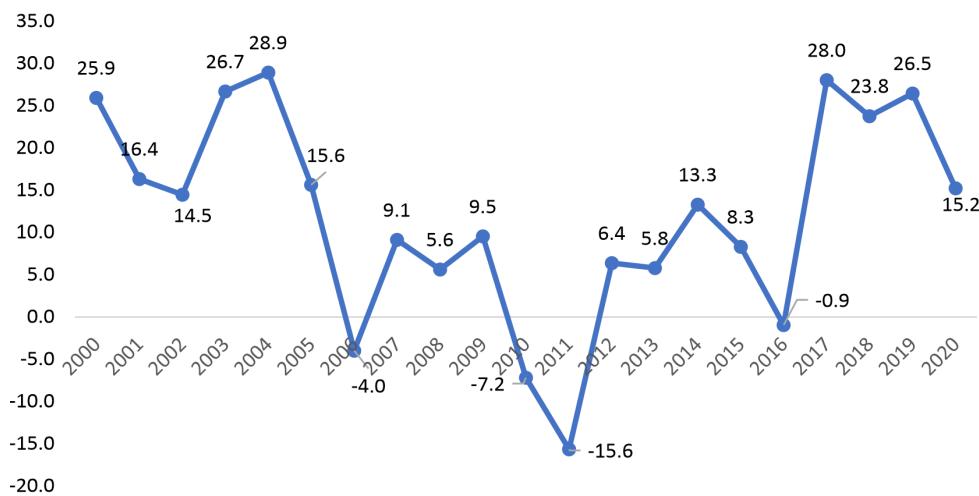


Figure 25 SCT for Indian refined sugar (percent)

Source OECD

industry have high amount of biochemical oxygen demand (BOD) load, chemical oxygen demand (COD), total suspended solids (TSS), sulphate (Ranjan et.al 2021). These pollutants can cause damage to water resources in the nearby areas if not discharged properly. Most the cases of pollution are observed in UP where there are cases of pollutants being discharged in river Ganga without being treated. Several legal cases have also been made against the sugar mills in the areas. To address these problems, Central Pollution Control Board (CPCB) introduced a charter to effectively regulate discharge of wastes into freshwater. In addition, a compensation plan was also designed and implemented under the charter for sugar industries situated in and around river Ganga.

v. **Impact on well-being of people employed in the industry**

Individuals employed in the sugar industry face costs related to socio-economic factors such as poor working conditions for on farm and sugar mills. In addition, special mention is to be made for women workers on the farm who are forced to undertake hysterectomies to avoid absence from fields in Maharashtra. Over 13,000 females in Beed district of Maharashtra have undergone hysterectomies to avoid daily wage losses (Mulye 2019). Maharashtra State Commission for Women ordered to set up a committee to look at the grave problem in 2019 (The Wire 2019). The committee reported that migrant women workers are promised Rs. 1,50,000 as annual wages but must work 12 hours daily. As per Oxfam 2020, these labourers took advances on wages from contractors for the procedures. These women also experienced grave sexual and reproductive health issues.

Conclusions and policy implications

Sugar is one of the most tightly regulated agricultural commodities in India. It is also one in which mostly every stage of value addition has some mechanism of government support. Starting from FRP (or SAP) for cane farmers, to soft loans for mills to fixing sugar ex-mill prices to setting quotas for releasing sugar from the mills, to providing support to the mills for producing ethanol or exporting sugar, GOI has a mechanism of

support. This results in distortion, inefficiency, and excessive production of sugarcane.

Overall, it appears to be a classic case of how one distortion snowballs into an intricate web of distortions. Based on our analysis, we propose the following policy recommendations.

Pricing of sugarcane

- i. Remove State Advised Prices (SAP): The SAPs are declared over and above the FRP declared by the GoI. There is a need for state governments to accept recommendations of the Rangarajan Committee Report and not declare SAPs going forward.
- ii. Rationalize increases in FRP: The FRP should be made a function of domestic demand and production costs in addition to global demand, supply, and prices of sugar. This may require only moderate increase in FRP of sugarcane.
- iii. Bring inter-crop price parity: Higher FRP of sugarcane needs to be moderated in the interest of inter-crop parity, ecological sustainability, and long-term health of sugar sector as a whole.

Market for by-product of sugar

- i. Ethanol: The national bio-fuel policy of Government of India (2018) had recommended a target of 10 percent blending of ethanol in petrol by 2021-22 and 20 percent by 2030. By 2021-22, India has already reached 9.3 percent blending (target was 10 percent) (USDA 2022). Encouraged by its performance and to build on its momentum, in 2022, GOI revised the national bio-fuel policy and advanced the target of 20 percent blending to 2025-26 (NBP 2022). Recommendations in this regard are:
 - a. Bring dynamism to ethanol pricing- Instead of fixing the price of ethanol, a more transparent and scientific mechanism for determining ethanol prices may be introduced.
 - b. Diversion of cane to ethanol: With ambitious ethanol targets in the coming years, increased acreages in the country will move to cane thus requiring greater investments by both the public and private sector in making cane production more water- and fertilizer-use efficient.

- ii. Molasses: It is an important by-product of sugar industry, but it is tightly controlled in largest sugar producing state of Uttar Pradesh. The sugar mills are not free to sell entire production of molasses in the open market and a certain percentage, about 18-20 percent, is reserved for supply to manufacturers of country liquor. This fetches them lower price as compared to the open market price of molasses. Not only that, but the sugar mills are also required to maintain a certain ratio of monthly sale between reserved molasses and free molasses. This has an impact on profitability of sugar mills. There should be no restriction on movement of molasses from one state to another; and
- iii. To use the excessive production of sugarcane, the government may promote marketing of jaggery. The nutritional benefits of jaggery are not well known even to the educated sections of society. With the increasing incidence of Type 2 diabetes there is a need to better communicate the nutritional benefits of jaggery. The possibility of exporting jaggery from India should also be explored. The global market of NRIs and people of Indian origin should also be targeted for consumption of jaggery.

Processed sugar products

With a positive income elasticity of sugar of 0.06, we expect that with the growth of per capita income of the average Indian, the consumption of sugar will also increase. For ensuring safe consumption of sugar:

1. New labelling norms must be implemented: FSSAI is in the process of implementing a system of front of pack labelling under which packaged food items will have to carry health-stars. This system must be implemented in its true spirit across packaged food category. Under this system, based on Australia's experience, stars are assigned to a product for sugar, sodium, and saturated fat. However, they are offset for any positive components like (fibre, fruit, legume, nut, protein, and vegetable content. Awareness and education campaigns need to be designed for educating consumers about the star-rating system.
2. Unpackaged food: As there are no regulations for the products which are not sold in the packaged form, consumers must be made aware about the health effects of excess sugar and fat.

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