

March 18, 2015

Global

## Sustainable Economics The Bitter Aftertaste of Sugar

### A healthy diet is a key driver of long-term growth.

Alongside demographics, health is one of the key drivers of economic growth, government spending and consumer trends. In this report, we look at the role of nutrition, specifically sugar consumption, across DM and EM.

### 'Diabetes' takes a toll on work force & public budgets.

We find that while DM sugar consumption is starting to fall and that overweight (including obesity) might be stabilizing in some countries, both are still on the rise in EM. Our analysis suggests though that EM sugar consumption won't fully converge to DM levels.

### Output at risk from excess sugar consumption.

Our simulations of the potential impact on GDP growth over the next 20 years show high output losses in Chile, the Czech Republic, Mexico, the US and Australia while Japan, Switzerland, France, Italy and Belgium should have relatively small losses.

### Consumer attitudes don't recognise danger of sugar.

Our AlphaWise survey confirms that awareness of the sugar content of food is limited and that sugar taxes are unpopular. Hence to tackle "diabetes", a combination of public sector education and private sector innovation would probably be more successful.

### Looking beyond the sugar tax & nutrition campaigns.

In addition to public policy initiatives to promote healthier nutrition, the private sector has started to tackle the issue through product innovation, notably in the food and beverages sectors. Examples include reducing portion sizes, using healthier ingredients, reducing sugar content, and improving the information on labels and packaging.

### Winners and losers in food and beverages.

The global Calorie Carbonated Soft Drinks (CSDs) industry is likely to be the key loser from a decline in sugar consumption. So far mid-calorie products and sweetener innovation in the CSDs industry have generally failed. The outlook for the Food Producers is dependent on how companies choose to develop their product ranges. Those that proactively adapt their portfolios should fare best.

### Huge unmet demand for drugs to treat diabetes.

Global pharmaceutical companies exposed to obesity and diabetes include Novo Nordisk, Sanofi, AstraZeneca, Eli Lilly, Merck, Pfizer and Ono. Massive unmet medical need for diabetes and obesity related drugs suggests that even if sugar consumption declines Pharma companies may not be negatively affected.

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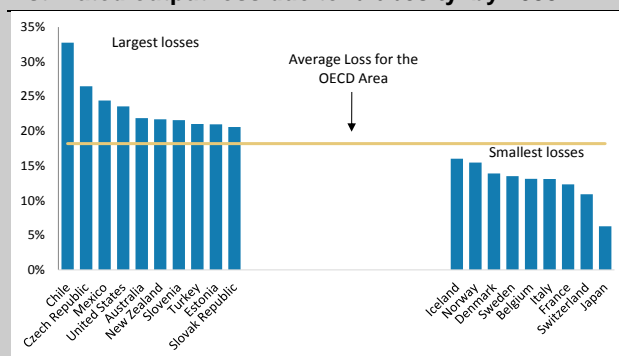
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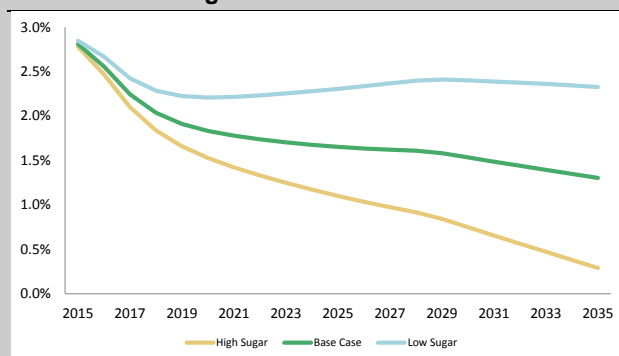
ALPHAWISE   
evidence-based research

### Estimated output loss due to 'diabetes' by 2035



Percentage points. Cumulative losses.  
Source: Morgan Stanley Research estimates

### The obesity and diabetes epidemic poses threat to future economic growth



The chart shows real GDP growth in the OECD area under simulations which adjust long-term OECD forecasts for different productivity levels of normal-weight, obese and diabetic individuals, and assume different levels of sugar consumption per capita in the high- and low-sugar scenarios.  
Source: Morgan Stanley Research

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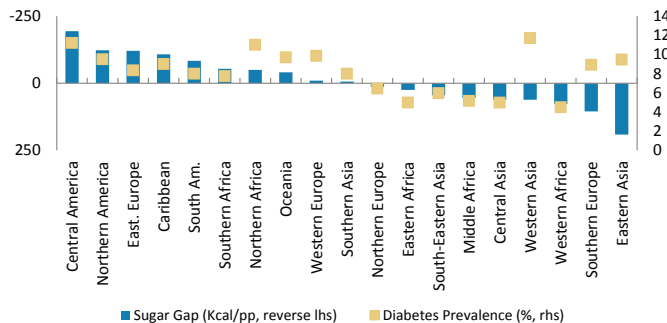
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DEBATE	CONSENSUS VIEW	OUR VIEW
Is sugar consumption going to cause a global health crisis?	Sugar is increasingly becoming the main scapegoat for the growing epidemic of obesity and diabetes.	<b>It is not clear whether sugar is <i>directly</i> linked to the rise in 'diabesity', but amid global changing dietary patterns, it has contributed to rising calorie imbalances, along with reduced physical activity.</b> Despite the vast number of medical studies conducted in this area, there is still no conclusive proof that sugar <i>alone</i> is a direct cause of obesity or diabetes but at the very least is a risk factor. Rising energy imbalances matter for health, which alongside population is one of the key drivers of long-term growth dynamics, public sector expenditure and secular consumer trends.
Is this mainly an issue for DM countries?	Obesity and diabetes are growing rapidly, but they are mainly problems of wealthy and ageing countries.	<b>In some developed market countries, sugar consumption has already started to shrink.</b> This is probably in response to heightening health-related concerns. However, these shifts have not received much attention.  <b>In contrast, population trends and rising sugar preferences portend a large boost to sugar demand in emerging markets, which will be the main drivers of the sugar market in coming decades.</b> Nevertheless, local preferences and the echo of health-related concerns from the developed world probably will prevent a convergence of sugar demand in developing countries to 'Western' standards, we think.  <b>Investors have probably not focused enough on the fact that 'diabesity' is increasing at an alarming rate also in developing countries. Moreover, it is escalating among children and adolescents.</b> The earlier the onset of the conditions, the higher the long-term costs because of risks of complications and premature mortality.
What are the costs of 'diabesity' to the global economy?	The spotlight tends to be on the impact on healthcare costs (direct costs).	<b>In addition to the burden of 'diabesity' on healthcare costs, investors should be concerned about the implications for long-term growth via productivity losses (indirect costs).</b> These can be sizable and, according to our simulations, potentially largest for the countries where obesity and diabetes levels are already high (Chile, Czech Republic, Mexico, US, Australia and New Zealand, in the OECD area, Russia, Brazil and South Africa, among the BRIICS). Despite their relatively low levels of obesity, China, India and Indonesia are also exposed to the 'sugar threat': because of their populations' genetic predisposition, diabetes can be triggered by much smaller weight gains than in Western countries.
What secular changes/shifts should investors look out for?	The focus is on whether government intervention can induce healthier consumer habits.	<b>Whilst the sugar tax attracts much attention and controversy, amidst the measures that could promote 'healthier' consumer trends, investors are probably overlooking the progress that the private sector has already started making.</b> Most of the changes are occurring in the food and beverage sector, via new marketing strategies and product innovation, but not only: molecular biology technology is also spearheading efforts to discover anti-obesity/diabetes drugs or equipment to alter the way our metabolism works or in which our brain responds to different nutrients.  <b>A combination of public/private policy action will likely be required to trigger individual behavioral changes.</b> Ultimately, though, sustainable progress will only be achieved via a better public understanding of the two sides of the calorie imbalance (intake and expenditure). To this end, both education campaigns and the contribution of the private sector are key, we think.

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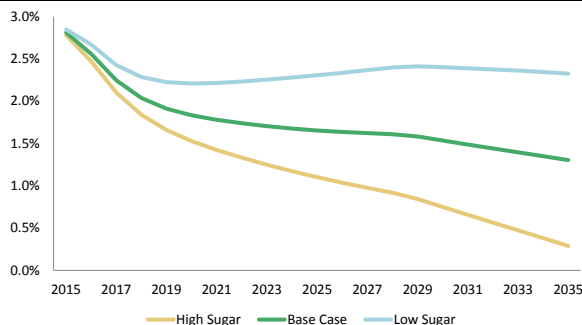
## At a Glance

**Exhibit 1**  
**In regions where sugar consumption is higher than justified by income levels diabetes tends to be high too**



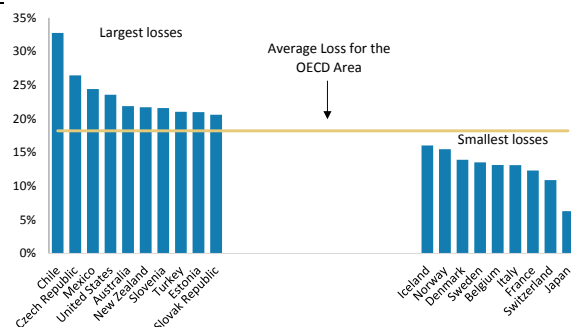
The sugar gap is shown in reverse scale. A negative/positive gap means that a region consumes more/less sugar per capita than would be consistent with its GDP per capita level. pp per person.  
Source: FAO, IDF, Morgan Stanley Research

**Exhibit 2**  
**The obesity and diabetes epidemic poses threat to future economic growth**



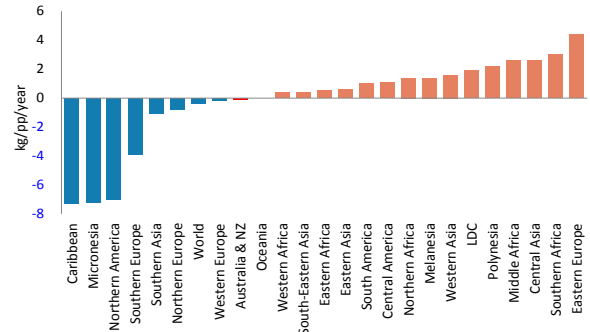
The chart shows real GDP growth in the OECD area under simulations which adjust long-run OECD forecasts for different productivity levels of normal-weight, obese and diabetic individuals, and assume different levels of sugar consumption per capita in the high- and low-sugar scenarios. Source: Morgan Stanley Research

**Exhibit 3**  
**Some countries would lose more than others long term, especially where 'diabetes' is already high**



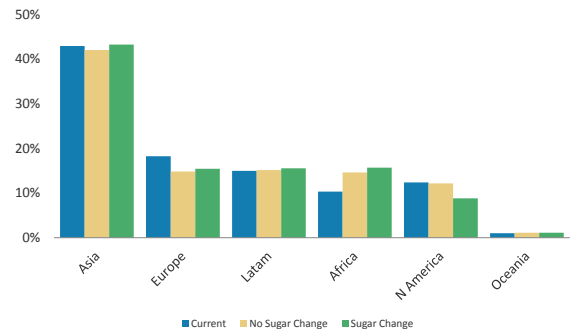
Cumulative output loss to 2035 vs OECD fcsts. Source: Morgan Stanley Research estimates

**Exhibit 4**  
**Sugar consumption is increasing in EMs but not many have focused on emergent declines in DMs**



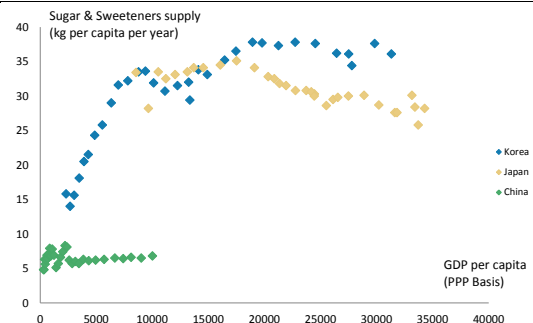
The bars show the regional changes in sugar and sweeteners consumption per capita in 2001-2011.  
Source: FAO, Morgan Stanley Research

**Exhibit 5**  
**Population trends and rising sugar preference point to further EM consumption gains and contractions in DMs**



Regional share of global sugar consumption in 2035 under different scenarios (see page 24)  
Source: FAO, Morgan Stanley Research

**Exhibit 6**  
**Local factors will likely prevent convergence to a 'common' international norm though**



Source: FAO, World Bank, Morgan Stanley Research

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## How Too Sweet Could Turn Sour

**Alongside demographics, health is one of the key drivers of long-term growth dynamics, public sector expenditure and secular consumer trends. In this report we focus on nutrition, specifically sugar consumption, and its impact on long-term growth in developed and emerging markets, as well as the expected incidence of sugar-related illnesses such as diabetes and obesity and their impact on the workforce.**

**Average calorie consumption globally has increased by around 30% over the last 50 years...** The world has experienced a considerable surge in the amount of food available per person since the 1950s. Amid rising economic growth, incomes and urbanization, diets have tended to shift from heavy consumption of grains and starchy staples, to more protein-intensive meals, oils, fat and sugar.

**... and sugar is increasingly seen as the main culprit.** Sugar has attracted growing attention among policy makers, non-profit organizations and investors, as medical research has increased knowledge of how sugar intake affects human body's chemical balance and its role as a contributor to excessive calorie intake. In the media, sugar has become the main scapegoat for increasing weight, along with fat (if not replacing it as the main culprit). Indeed, it has already been dubbed "the new tobacco" for its health risks (see [www.nutrition.org.uk](http://www.nutrition.org.uk)). And the WHO reduced this month its recommended amount of daily intake of free sugars for adult and children from 10% to 5% of their daily energy intake.

**Attention so far has focused mostly on the direct costs of excessive sugar consumption and calorie imbalances.** Direct costs boost healthcare spending on diet-related conditions (largely obesity, diabetes and their complications), whilst indirect costs materialize via productivity losses.

**In this report we model the indirect cost of 'diabesity' and its impact on long-term economic growth.** Our simulations show that a reduced workforce and lower productivity (via premature deaths, exit from the labor force and/or poorer performance at work) can significantly affect economic growth relative to baseline projections. This is of particular concern in sectors such as services because they are labor intensive. Moreover, the issue has become even more pressing following the end-2014 European Court of Justice ruling concluding that obesity can be considered a disability. On a

positive note, though, our model also suggests that small dietary adjustments (all else being equal) can bring significant long-term benefits to growth and health. Ultimately, though, sustainable progress will only be achieved via a better public understanding of the two sides of the calorie imbalance (intake and expenditure).

**Countries most at risk are those where obesity and related illnesses are already high, including many EMs.**

The countries which face the prospect of the largest economic losses are those where the prevalence of obesity-related illnesses and sugar consumption is already high, in the absence of action to curb the ongoing diabetes and obesity epidemic (e.g. the US, Australia, New Zealand, Spain and the UK within the OECD).

Moreover, emerging markets are more exposed to this threat (especially Chile, Mexico, Russia and Brazil), because the majority of people who are overweight, obese or have metabolic syndrome can now be found in the developing, rather than the developed world.

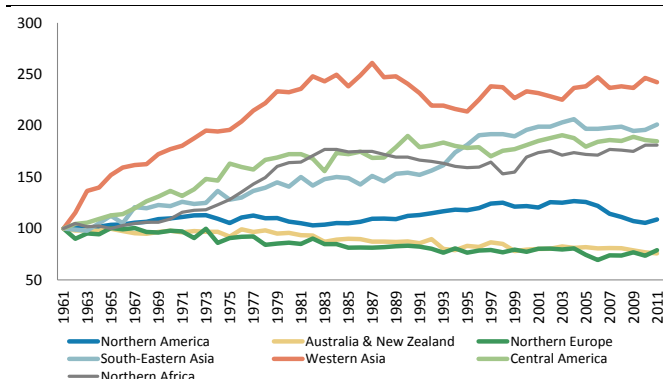
**Asian countries fare better because of their comparatively better starting point, as obesity levels are still low.** This is no cause for complacency though. As local diets adjust to higher income levels, increasing weight gain associated with rising urbanization and changes in lifestyles represent a higher risk factor than in developed countries, because of a genetic predisposition to diabetes. If the onset of the condition is at a young age, long-term costs will increase further, as well as the risk of complications and premature mortality.

**Signs that sugar demand in developed markets is beginning to recede have received little attention.** The magnitude of the changes is still too little to reverse the current 'diabesity' epidemic but the direction is encouraging (Exhibit 7). Consumers are shying away from full-calorie sodas and global sales of reduced-sugar packaged food are growing at a double-digit pace, albeit remaining still a niche market.

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Exhibit 7

### Sugar calories are Increasing in EMs but are beginning to shrink in DMs



The chart shows annual kcalories from 'sugar and sweeteners' per capita by region. 1961=100. Source: FAO, WHO Morgan Stanley Research

**Population trends, rising income and changing diets in EMs portend a large boost to local sugar consumption in coming decades.** However, contrary to meat-based proteins, in the case of sugar income is a weaker driver of demand. Instead, cultural factors and local preferences seem to play a key role. The echo of sugar-related health concerns in the developed world may also act as mitigating factor in developing countries, preventing a convergence of EM sugar consumption to DM levels.

**On balance, differences in sugar consumption per capita between the DM and EM world will continue to narrow but not converge fully while the growth of global sugar consumption will probably moderate further.**

**Despite this prospect, major challenges to reverse the current diabetes and obesity epidemic still lie ahead.** Overweight (including obesity) is stabilizing in some developed countries but is increasingly affecting emerging markets. Moreover, both conditions are rising rapidly among children and adolescents, creating even more upward pressure on long-term health care costs, because of the early onset of the condition and the risks of complications and premature death.

**Ultimately tackling this epidemic will likely require public intervention and support from the private sector.** Political appetite to step up action appears weak and much of the current debate revolves around the appropriateness of government intervention (via a 'sugar tax', tax incentives for 'healthy' foods or increased regulation). Nevertheless, investors are probably overlooking the progress that the private sector is already making on product innovation.

## Key Results of Our Economic Analysis

To provide a sense of how sugar and its effect on diet-related diseases might affect economic growth over the long run, we simulated trajectories for selected OECD and BRIICS countries to 2035.

**In our Base Case Sugar Scenario, GDP growth in the OECD countries averages 1.8% over the next 20 years.** This is half a percentage point lower compared to the projections made by the OECD (that is a cumulative loss of 18.2 percentage points over the next 20 years) (Exhibit 8).

Exhibit 8

### Average annual real GDP growth: Base Case Sugar Scenario vs OECD long-term projections, 2015-2035

Country	Real GDP		Productivity	
	OECD Long-term Forecasts	Base Case Sugar Scenario	OECD Long-term Forecasts	Base Case Sugar Scenario
<b>OECD</b>	<b>2.3%</b>	<b>1.8%</b>	<b>1.9%</b>	<b>1.5%</b>
Australia	3.2%	2.7%	2.1%	1.7%
Canada	2.1%	1.5%	1.3%	0.9%
France	2.3%	1.9%	1.9%	1.7%
Germany	1.1%	0.4%	1.3%	0.9%
Italy	1.9%	1.5%	1.7%	1.4%
Japan	1.1%	0.9%	1.5%	1.4%
Korea	2.7%	2.5%	2.4%	2.3%
Mexico	3.1%	2.4%	2.2%	1.8%
New Zealand	2.5%	1.9%	1.7%	1.3%
Spain	1.9%	1.2%	1.5%	1.0%
United Kingdom	2.6%	2.0%	2.1%	1.6%
United States	2.5%	1.8%	1.8%	1.3%
<b>BRIICS</b>	<b>4.5%</b>	<b>4.2%</b>	<b>4.0%</b>	<b>3.8%</b>
Brazil	2.6%	2.0%	2.1%	1.7%
China	4.5%	4.1%	4.3%	4.1%
India	5.7%	5.6%	4.8%	4.7%
Indonesia	5.2%	5.1%	4.3%	4.2%
Russia	2.8%	2.0%	3.2%	2.6%
South Africa	4.6%	3.8%	4.0%	3.5%

The OECD forecasts do not include the impact of sugar consumption on health. In our Base Case Sugar Scenario we use the OECD forecasts as a starting point and adjust them for our assumptions on the different productivity levels of healthy, diabetic and obese individuals. Source: OECD, Morgan Stanley Research estimates

**The largest cumulative output losses are in Chile, Czech Republic, Mexico, US, Australia and New Zealand.** These countries all suffer from double-digit diabetes prevalence and have among the highest rates of obesity globally.

**In contrast, the smallest cumulative output losses are in Japan, Korea, Switzerland, France and Italy.** Traditionally diets in Japan and Korea are not sugar rich. France and Italy compare well for the same reasons (their obesity and diabetes rates are lower even by European standards). The case of Switzerland is interesting because, despite having one of the highest per-capita sugar consumption rates in the world, its diabetes and obesity rates are relatively low, partly because of comparatively high physical activity.

**Among the BRIICS countries, South Africa and Russia stand out with the largest cumulative loss of real GDP versus the OECD projections.**



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**All Asian countries (China, India and Indonesia) perform better.** This is because, despite having high diabetes rates by international standards (largely due to genetics), their obesity prevalence is relatively low. However, preventing a rise in obesity to Western standards is urgent because the onset of diabetes can be triggered by much smaller weight gains than in developed countries.

**Looking at sugar consumption developments and diet-related diseases three factors stand out:**

- 1) **There is burgeoning evidence in the DMs that sugar consumption is beginning to decline**, whilst it has increased in emerging markets and will likely continue to do so in coming decades, driven by population trends and rising sugar preference.
- 2) **Overweight (including obesity) may be stabilizing in some developed countries** where the debate about diet-related diseases has heightened recently.
- 3) **Diabetes and obesity are no longer a problem of wealthy countries, or only of adults**; what is changing is that the majority of people who are diabetic or obese are now in the developing, rather than in the developed world. Moreover, both conditions are rising rapidly among children and adolescents.

**Finally, our AlphaWise survey confirms that public awareness of the sugar content of food is limited. Furthermore, the 'sugar tax' is unpopular.** In contrast, the majority of respondents in the countries surveyed believes that the most important actions that governments should undertake to reduce sugar consumption are investing in education and improved labelling regulations.

## Key Stock Conclusions

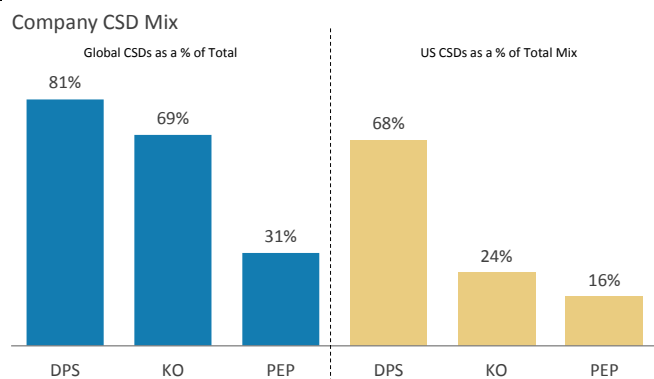
The impact of sugar consumption on productivity has implications for all industries, particularly those that are labor intensive. However, in addition, there are certain sectors that are also more directly affected by future trends in sugar consumption and related illnesses.

**The global Calorie Carbonated Soft Drinks (CSDs) industry is likely to be the key loser from a decline in sugar consumption.** Volume growth has already decelerated to around 1.1% CAGR, which is significantly below the 5.4% CAGR for all other soft drinks. Morgan Stanley's Beverage team expects this trend to continue going forward, although some of the volume pressure may be mitigated by better pricing or positive mix impacts. The most exposed companies are Coca Cola (KO), PepsiCo (PEP) and Dr Pepper Snapple Group (DPS). Together these three companies account for around 75% of the global CSD market. DPS is the most exposed (81% of global retail sales coming from CSDs) followed by KO (69% of sales) and then PEP (31% of mix due to its large global snacks business).

There is some possibility that going forward CSD companies could introduce more effective sweeteners that are natural, superior tasting and have lower calories, in order to gain more traction from consumers with sugar concerns. However, we believe a breakthrough product is unlikely given mid-calorie CSDs and sweetener innovation in the past have generally failed.

Exhibit 9

**DPS and KO are highly exposed to the CSD category, while PEP is relatively less exposed**



Source: Euromonitor, Morgan Stanley Research



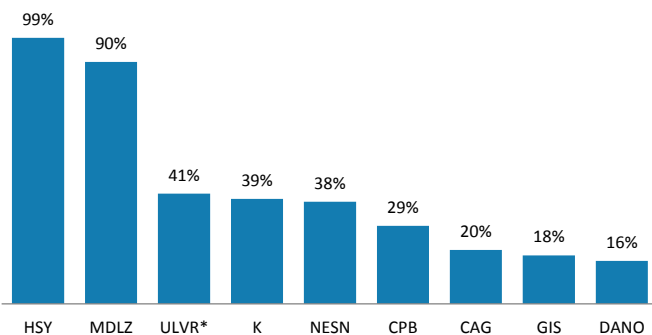
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**The outlook for the Food Producers is dependent on how companies choose to develop their product ranges.** Foods that are high in sugar (such as biscuits and sweet snacks) have been a resilient source of growth over the last five years. However, with signs of sugar consumption beginning to decline, there are obvious risks to this product line. The most exposed stocks are Hershey and Mondelez with around 100% and 90% of revenues respectively from sweet categories. The stocks in the Food Producer sector that should fare the best are those that are proactively adapting their portfolios, in our view. Examples of action being taken include reducing portion sizes, using healthier ingredients, reducing sugar content, and improving the information on labels and packaging. This should help companies attract customers who appear to be increasingly looking for “healthier” food products, and also reduce the risk should governments decide to tackle the problems associated with sugar consumption by imposing new calorie-related taxes.

Exhibit 10

## Percentage of sales from sugary categories

Exposure to Sweet/Savoury Categories



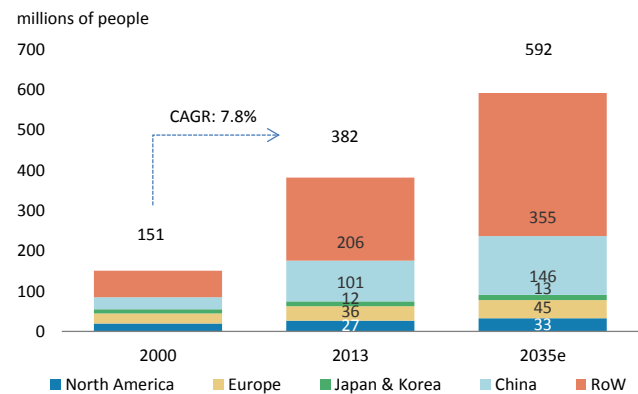
\* Unilever Food and Refreshment divisions combined. Source: Euromonitor, Company Data, Morgan Stanley Research

**Massive unmet medical need for diabetes and obesity-related drugs suggests that, even if sugar consumption declines, Pharma companies might not be negatively affected.** Trends in sugar consumption are also likely to have investment implications for the global healthcare sector given there does appear to be some evidence of a link between sugar, obesity and diabetes. Within global pharmaceuticals, the companies most exposed to diabetes and obesity are Novo Nordisk, Sanofi, AstraZeneca, Eli Lilly, Merck, Pfizer and Ono. All of these companies produce drugs that are used to treat diabetes and as such it follows that their outlook will be somewhat determined by the prevalence of this disease. As Exhibit 11 shows, it is the emerging markets that are likely to drive the diabetes epidemic over the next 20 years.

However, two other important dynamics of the pharmaceuticals market are market penetration and pricing. First of all, we believe there is a massive unmet medical need for diabetes and obesity-related drugs at present. As such, any decline in sugar consumption and consequently diabetes might not necessarily translate into reduced volumes for the pharmaceutical companies. With regards to pricing though, our central case is for pricing to remain weak, particularly in the US. This may even intensify if governments decide to intervene to reduce sugar consumption.

Exhibit 11

## Emerging markets are expected to drive the diabetes epidemic in the next two decades



Source: Novo Nordisk, International Diabetes Foundation (IDF); Note: 20-79 age group

**Reduced sugar consumption would be marginally negative for Medtech companies.** The Medtech sector is exposed to sugar-related diseases in a range of different ways such as dialysis, wound care (e.g. for diabetic ulcers), clinical nutrition and cancer-related products. A moderation in sugar consumption would be marginally negative for companies such as Fresenius, Elekta, Smith & Nephew, Coloplast and Getinge.

**Reduced sugar consumption could be a positive driver for the US Managed Care Organisations (MCOs) industry.** The industry is currently suffering from rising cost pressures, with obesity and diabetes cost trend displaying minimal signs of moderation and federal/state governments increasingly looking to managed care as a source of saving. As such, a reversal of the current growth of these conditions could be a positive driver for the MCOs. Indeed, analysis by the Trust for America's Health and Micro Health Simulations suggests that a 5% reduction in US obesity prevalence rates could result in cost savings of \$29.8bn in five years rising to \$611.7bn in 20 years. Key companies in this sector include Aetna, Cigna Crop and UnitedHealth Group.

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## Setting the Stage

**Alongside demographics, health is one of the key drivers of long-term growth dynamics, public sector expenditure and secular consumer trends.** Economic activity has traditionally been attributed to the accumulation of human and physical capital, along with increased productivity arising from technological advances. Thus, as one of the major factors behind economic growth, health of human capital is important, because it can influence changes to employment/population ratios and labor force participation rates, as well as productivity of the workforce. Moreover, via its effects on spending patterns, it can affect aggregate demand.

**Diet matters for health.** By contributing to wellbeing and happiness, it allows individuals to function actively, reducing the risk of diseases. The energy provided by food calories is needed for an effective functioning of the body, including not just physical activity but also cerebral functioning, growth and healing.

**Food has never been more abundant globally.** The world has experienced a considerable surge in the amount of food available per person since the 1950s. Improvements in food supply and a gradual reduction of dietary deficiency normally accompany economic development.

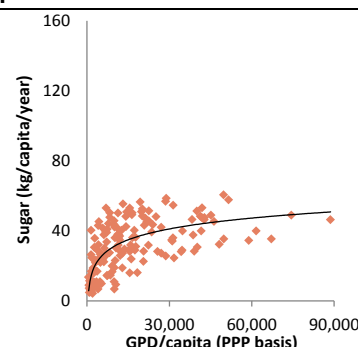
**Consumption of sugar and meat increases as per capita GDP rises.** Diets have tended to shift from heavy consumption of grains and starchy staples (which meet energy requirements at a relatively low cost) to more protein-intensive meals, oils, fat and sugar. However, whilst there is a clear positive relationship between sugar consumption and a country's per capita income, it is weaker than that for meat. In contrast, there appears to be little relationship for consumption of grains (Exhibit 12-14).

**Dietary shifts are a normal development in the 'nutrition transition' that accompanies a country's development.** The nutrition transition model postulates that countries' diets evolve through five main stages, preceded by, or along with the demographic transition (the shift from high to low fertility and mortality) and the epidemiological transition (the shift from prevalent infectious diseases to chronic and degenerative diseases associated with urban-industrial lifestyles).<sup>1</sup> Taking the cue from the nutrition transition model, we have designed Exhibit 15 overleaf, which shows some of the changes, preceding or accompanying dietary shifts, and examples of selected countries, depending on their positioning on the transition ladder.

<sup>1</sup> The 'nutrition transition' model was first proposed by Prof. Barry Popkin (see [www.cpc.unc.edu/projects/nutrans/whatis](http://www.cpc.unc.edu/projects/nutrans/whatis)).

Exhibit 12

**Sugar and sweeteners consumption increases as GDP (PPP) per capita rises ...**

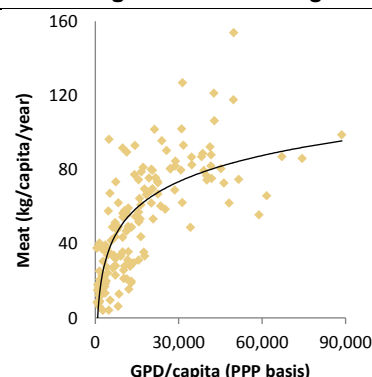


Note: 168 countries were used

Source: FAO, Morgan Stanley Research

Exhibit 13

**... although meat consumption has a stronger relationship with rising income than sugar ...**

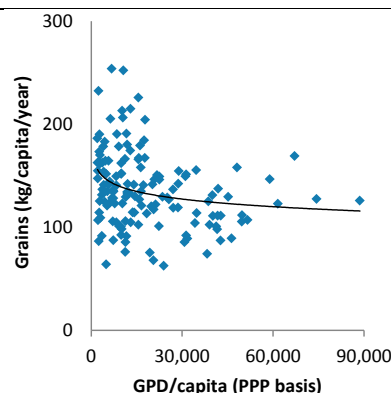


Note: 168 countries were used

Source: FAO, Morgan Stanley Research

Exhibit 14

**... while rising income levels have little impact on grains consumption**

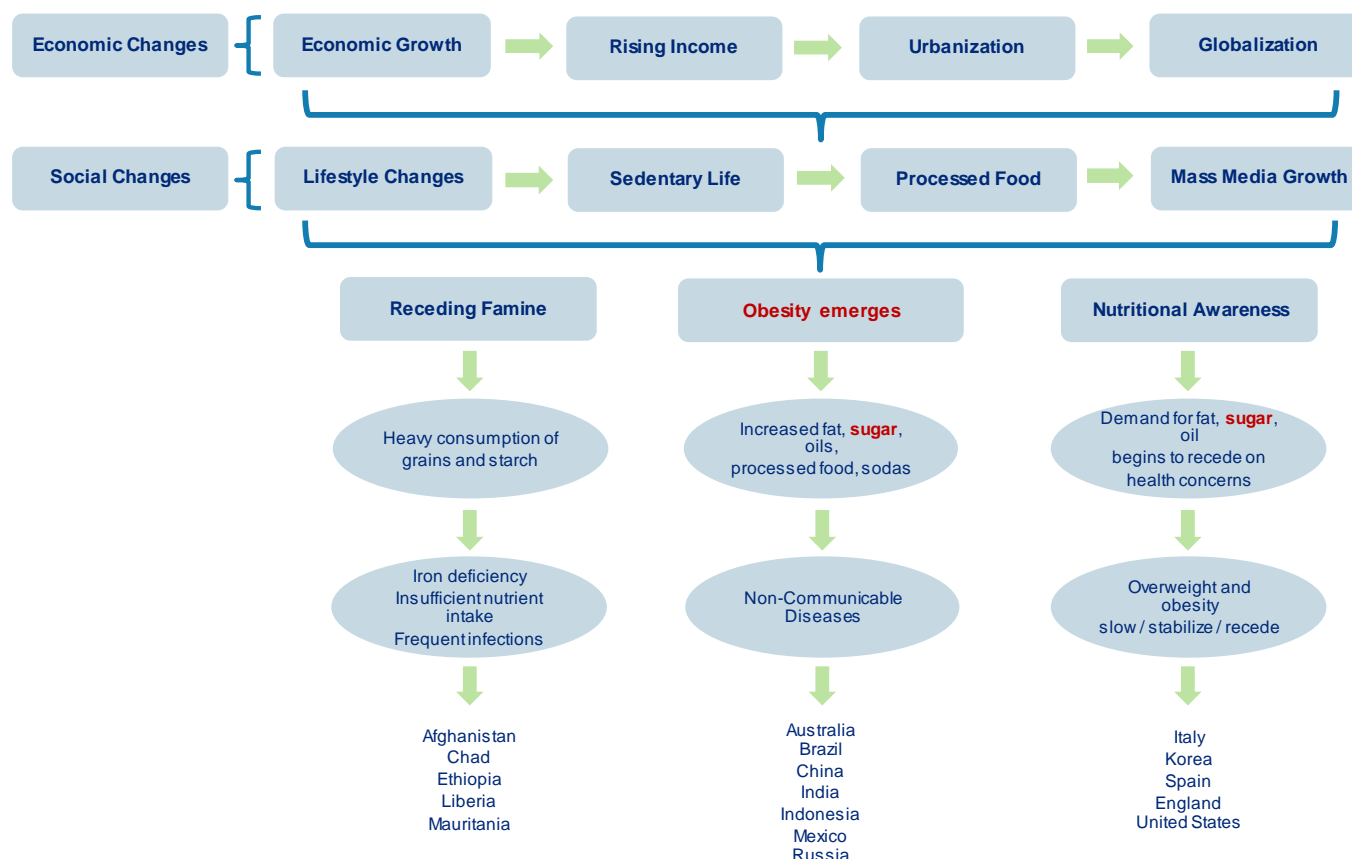


Note: 168 countries were used

Source: FAO, Morgan Stanley Research

Exhibit 15

### Examples of countries in different stages of dietary shifts

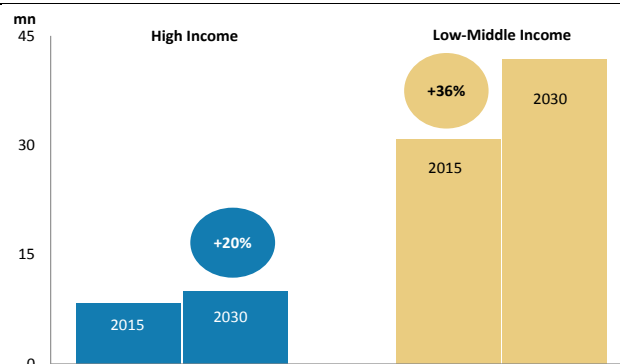


Source: Morgan Stanley Research

**Malnutrition is no longer associated with under-nourishment but with overeating and consumption of unhealthy foods.** Whilst the battle against malnutrition is not won yet – with nearly 900 million people still facing dietary deficiencies – medical and nutrition research are focussing increasingly on the effect that excessive consumption of fat, salt and sugar have on the rising global incidence of overweight, obesity and of non-communicable diseases (NCDs) – these include diabetes, cardiovascular problems and, importantly, some cancers. Although partly driven by ageing, NCDs have escalated recently and have been increasingly linked to rising unhealthy lifestyles and excessive energy intakes, which have accompanied globalization and urbanization (Exhibit 16).

Exhibit 16

### Deaths due to non-communicable diseases (NCDs)


World Bank country income groups.  
Source: WHO, Morgan Stanley Research

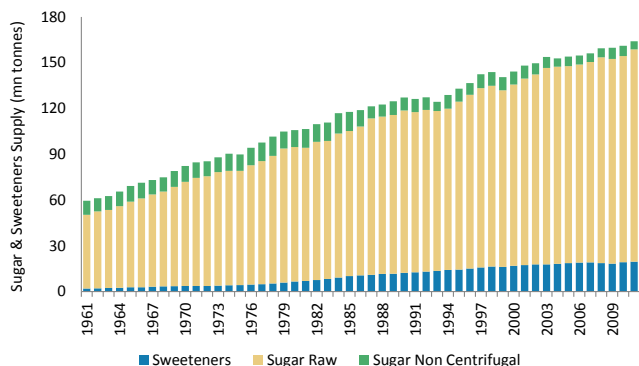
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**Sugar has been dubbed the ‘new tobacco’.** With increased knowledge of how sugar intake affects human body’s chemical balance and its role as a contributor to excessive energy intake, sugar has attracted growing attention among policymakers, non-profit organizations and increasingly investors. In the media it has become a major scapegoat for increasing weight, along with fat (if not replacing it as a main culprit). Indeed, it has already been dubbed “the new tobacco” for its health risks.<sup>2</sup>

**Sugar consumption per capita has increased almost fivefold over the past century.** At the beginning of the 20th century, a world population of 1.6 billion people consumed roughly 8 million tonnes of sugar, i.e. 5.1 kg per capita. Today, a world population of 7 billion consumes 166 million tonnes of sugar (including high-intensity sweeteners), that is 24kg per person (equivalent to around 230 k/calories per day or 8% of the total daily energy intake) (Exhibit 17).

Exhibit 17

**Global sugar and sweeteners consumption has nearly trebled since the 1960s**



Non-centrifugal sugar is a residual product obtained by evaporating the water in the sugar cane juice; it is known by many names in different parts of the world such as panela, jaggery, muscovado

Source: FAO, Morgan Stanley Research

**Sugar is not new to our diets but its intake has increased significantly over the past fifty years amidst rising incomes, urbanization and the use of processed food.**

Indeed, with sugar coming from a variety of sources, and often hidden in processed food, because it is used as a preservative or flavour enhancer in processed and packaged food, it is difficult to keep track of how much sugar an individual consumes on a daily basis. Our AlphaWise survey confirms that respondents are not aware of the sugar content of food.

In the remainder of this note, as a proxy for sugar consumption, we will use the Food and Agriculture Organization (FAO) supply balance sheet data on ‘sugar and sweeteners’, which include sucrose (table sugar), glucose, honey, high-fructose corn syrup as well as some high-intensity sweeteners. For a detailed analysis of the different types of existing sugars and sweeteners see ‘Appendix: From White Gold to Demon’ on page 61.

<sup>2</sup> [www.nutrition.org.uk](http://www.nutrition.org.uk)

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## How Much Is Too Much Sugar?

**Sugar is a type of carbohydrate and provides energy for the body in the form of glucose, which is the fuel used by brain cells.** These are always in a state of metabolic activity, even during sleep, and consume nearly 10%-20% of the whole body's energy. Muscles also need glucose when we move or during exercise.

**The human body requires glucose for the normal functioning of the brain and other tissues.** Glucose is one of the primary molecules which serve as an energy source also for plants and animals. Because neurons cannot store glucose but depend on the bloodstream for their supply, glucose is referred to as "blood sugar".

**There is no simple answer to the question of how much sugar an individual can eat safely per day.** The amount depends on a person's size, age, physical activity and genetics. Because of different metabolisms, some people can eat sugar without harm, whilst others should avoid it. Moreover, sugar comes in different shapes and with different names (see 'Appendix: From White Gold to Demon' on page 61).

**Health authorities also differ on the recommended daily amount.** For example, in the UK the NHS indicates that added sugar should not represent more than 10% of adults' daily calorie intake. This is about 70g for men (270 calories of 17½ teaspoons) and 50g for women (194 calories of 12½ teaspoons). In the US, the thresholds are lower: the American Heart Association recommends 37.5 g (145 calories per day or 9 teaspoons) for men and 25 g for women (97 calories or 6 teaspoons), i.e. half of the UK guideline.

**By the new WHO guidelines, consumption is already excessive globally.** After a public consultation, in March 2015, the World Health Organization (WHO) kept its recommendation for the daily intake of free sugars for adults and children at less than 10%. However, it added that a further reduction to less than 5% would provide additional health benefits (the guidelines do not apply to the sugar in fresh fruits, vegetables and present in milk). For an adult of normal Body Mass Index (BMI), this is equivalent to 25 grams or 6 teaspoons of free sugar. What is striking is that by the new WHO metric, all regions of the world, excluding Eastern Asia and Western Africa, are already at or even already exceed the new mark (Exhibit 18).

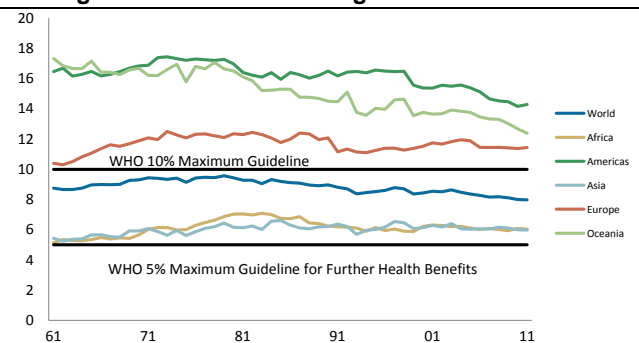
**Medical research has contributed to the discussion by shedding more light on how sugar affects the body's medical balance and health.** The case against sugar, especially fructose, was initially brought to the fore more than 40 years ago, by British physiologist John Yudkin with his book 'Pure, White and Deadly'. He faced considerable resistance from the health establishment because the

mainstream thinking at that time was that saturated fat was to blame for the rising tide of heart disease and obesity.

**Increasing evidence that sugary drinks are the most detrimental to health.** Findings have not always been conclusive since then but it has become increasingly accepted that sugar taken in a liquid form (via soda drinks) satiates less than in solid form, thus resulting in increased consumption and adding to excessive calorie intake.<sup>3</sup>

Exhibit 18

### Sugar & sweeteners as percentage of total calorie intake – all regions exceed new WHO guidelines



From March 2015, the WHO recommends that maximum sugar daily intake for adults and children should be less than 5% of the daily energy intake for additional health benefits. Source: FAO, WHO Morgan Stanley Research

### Consumption of processed foods linked to weight gain.

More broadly, research has documented that consumption of processed foods that are higher in starches, refined grains, fats and sugar can increase weight gain: these foods are less satiating than an equivalent number of calories from less processed, high-fiber foods, which are digested more slowly and therefore reduce hunger signals.<sup>4</sup>

**Not all calories are the same and 'what' we eat can make a big difference to 'how much' we eat.** It has also been suggested that sugar is addictive and that sweets and soft drinks should carry cigarette-style health warnings.<sup>5</sup> However, critics of these theories argue that the effect of sugar consumption on body weight depends not just on body metabolism but also on behavioral intent, availability and cost of food.<sup>6</sup>

<sup>3</sup> Di Meglio DP, Mattes RD, Liquid versus solid carbohydrate: effect on food intake and body weight. *International Journal of Obesity and Related Metabolic Disorders*, June 2000.

<sup>4</sup> Dariush Mozaffarian et al., Changes in Diet and Lifestyle and Long-term Weight Gain in Women and Men, *The New England Journal of Medicine*, June 2011.

<sup>5</sup> Nicole M. Avena et al., Evidence for sugar addiction: Behavioural and Neurochemical Effects of Intermittent, Excessive Sugar Intake, *Neuroscience & Behavioral Reviews*, 2008.

<sup>6</sup> Adam Drewnowski and France Bellisle, Liquid calories, sugar and body weight, *The American Journal of Clinical Nutrition*, 2007.



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## The Rise of Diabetes?

**Whether there is a *direct link* between high sugar consumption and the rise in obesity is still controversial.**

For example, a recent WHO-funded review on sugar and obesity confirmed that the most consistent association has been between high consumption of sugar-sweetened beverages and the development of obesity. However, it found that for the same amount of excess calories, taken either via sugar or other forms of carbohydrates, the resulting weight gain was comparable.<sup>7</sup>

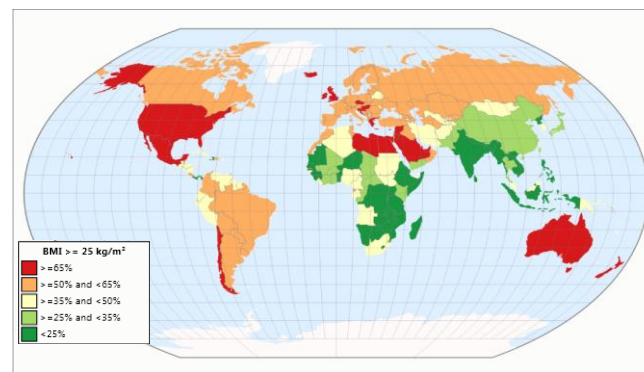
**Obesity depends also on many factors including genetics, economic/education background and life-styles.**

These other factors are beyond the scope of this report. There is even new evidence that shorter sleeping patterns, especially among children and adolescents, may affect obesity. Sleeping patterns can alter the balance of key hormones that control appetite (leptin and ghrelin); they increase the preference for snacking and make people too tired to exercise.<sup>8</sup>

**Nevertheless, there are few doubts that the sizable increase in sugar consumption has *contributed* to rising energy imbalances.** It is no longer news that overweight and obesity have reached epidemic proportions. In fact, even the WHO now refers to it as '*globesity*'. Worldwide the number of overweight and obese (age-standardised) more than doubled from 875 million in 1980 to 2.1 billion in 2013. As a share of the population, men with BMI  $\geq 25\text{kg/m}^2$  rose from 28.8% to 36.9% and women from 29.8% to 38% (Exhibit 19-20). Even more alarming, prevalence has increased substantially in children and adolescents, with some arguing that today's children are 'programmed' to be overweight (see [www.obesityaustralia.org](http://www.obesityaustralia.org)).

Exhibit 19

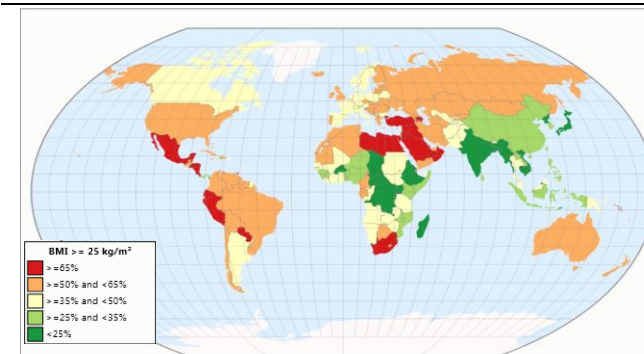
### Age-standardised regional prevalence of overweight and obesity (men), 2013



Source: Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013 (doi:10.1016/S0140-6736(08)61345-8), Morgan Stanley Research

Exhibit 20

### Age-standardised regional prevalence of overweight and obesity (women), 2013



Source: Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013 (doi:10.1016/S0140-6736(08)61345-8), Morgan Stanley Research

<sup>7</sup> Lisa Te Morenga et al., Dietary sugars and body weight: a systematic review of meta-analyses of randomised controlled trials and cohort studies, *BMJ* 2013; 346:e7492, 2013.

<sup>8</sup> Patel SR, Hu FB, Short sleep duration and weight gain: a systematic review. *Obesity* (Silver Spring). 2008; Patel SR, Malhotra A et al, Association between reduced sleep and weight gain in women. *Am J Epidemiol*. 2006; Kristen L. Knutson. Does inadequate sleep play a role in vulnerability to obesity? *American Journal of Human Biology*, 2012.

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## SUGAR CUBE #1:

### WHAT IS BMI AND WHAT ARE ITS LIMITS AS A RISK INDICATOR?

Overweight and obesity are defined as abnormal or excessive fat accumulation and are commonly measured by the Body Mass Index (BMI). This is a simple index that is calculated by dividing an adult person's weight in kilograms by the square of his or her height in meters ( $\text{kg}/\text{m}^2$ ). It is not the only measure to assess a person's weight but it is the most commonly used. The WHO definition is<sup>9</sup>:

A BMI greater than or equal to 25 is overweight

A BMI greater than or equal to 30 is obese

On average the age-standardised mean BMI has increased by 0.4-0.5  $\text{kg}/\text{m}^2$ /year over the past three decades.

**This measure has several drawbacks.** For example, its values are age-independent, are the same for both sexes (the thresholds are for adults and do not apply to children) and its interpretation in relation to risks may differ across population. This is because the cut-off points of 25  $\text{kg}/\text{m}^2$  and 30  $\text{kg}/\text{m}^2$  that define overweight and obesity, respectively, may not be suitable for all ethnic groups: the same degree of fatness in different populations may be due to different body proportions and fat distribution.

Indeed, the proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is substantial at BMIs lower than the existing WHO cut-off point for overweight (= 25  $\text{kg}/\text{m}^2$ ).<sup>10</sup> For this reason, other measures of central obesity, such as 'waist:hip' ratio and waist circumference are also used to measure obesity, since visceral fat, particularly in the abdominal region, has a stronger association with type 2 diabetes and cardiovascular disease than BMI.

**Moreover, there is general agreement that obesity is linked to a range of health problems.** The list is long: someone with an obese BMI has a 9 times greater risk of developing Type 2 diabetes, > 3 times higher risk of hypertension, 3 times as high a risk of colon cancer, > twice as high a risk of heart attack, 65% higher a risk of osteoarthritis, 33% higher risk of a stroke.<sup>11</sup> Other complications include coronary artery disease, venous thromboembolism, some forms of cancers, sleep apnea, liver disease and pancreatic disease.

**The close link between obesity and diabetes is so well documented that many experts refer to it as 'diabesity'.<sup>12</sup>** The term covers a range of signs, including obesity, insulin resistance, metabolic syndrome and diabetes. Even on this front, the numbers are alarming. Currently 387 million people have been diagnosed with diabetes (8.3% of the global

population, more than double the number in 1980). Of these, 42% live in China and India alone. Moreover, about 316 million people have Impaired Glucose Tolerance (IGT), a pre-diabetic state of hyperglycemia (increased blood sugar). More worrisome, around 175 million may have undiagnosed diabetes, because symptoms may take years to become apparent, whilst in the meantime the body is damaged by excess blood glucose.

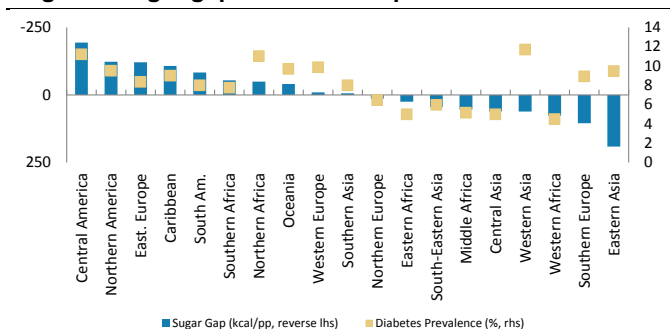
**Worldwide 80% of people with Type 2 diabetes are overweight or obese at the time of diagnosis.**<sup>13</sup> The connection between diabetes and sugar is more evident than with obesity, partly because the syndrome in itself is a dysfunction related to the level of glucose in the blood, either because the pancreas does not produce enough insulin (Type 1 diabetes) or the body does not respond properly to the insulin produced (Type 2 diabetes).

**A regional comparison of diabetes rates shows a positive correlation with the 'sugar gap'.** The 'sugar gap' is defined as the difference between the amount of a region's per capita sugar consumption and the amount that would be consistent with its per capita GDP (Exhibit 21).

As a result, regions that have comparatively higher sugar consumption also tend to have relatively high rates of diabetes and vice versa. The exceptions are Western, Eastern Asia (where diabetes is high also for genetic reasons) and Southern Europe (which has not a 'sweet tooth' but has a diet rich in other forms of carbohydrates).

Exhibit 21

### Regional sugar gap and diabetes prevalence



Note: The sugar gap is shown in reverse scale. A negative/positive gap means that a region consumes more/less sugar per capita than it would be consistent with its GDP per capita level. pp per person.

Source: FAO, IDF, Morgan Stanley Research

<sup>9</sup> WHO - Global database on BMI

<sup>10</sup> In response to a growing debate on whether different BMI cut-off point should be considered for different ethnic group, the WHO convened the Expert Consultation on BMI in Asian populations in 2002. However, it concluded (Singapore, 8-11 July, 2002) that the current cut-off point should be retained as the international classification but recommended that additional cut-off points (i.e. 23, 27.5, 32.5 and 37.5 and 40  $\text{kg}/\text{m}^2$ ) should be used for reporting purposes to facilitate international comparisons.

<sup>11</sup> International Diabetes Task

<sup>12</sup> Dr. Francine Kaufman coined the term diabesity, which is defined as 'a metabolic dysfunction that ranges from mild blood sugar imbalance to full-fledged Type2 diabetes' (Kaufman, F.R. Diabesity: The Obesity-diabetes Epidemic that threatens America and what We Must Do to Stop it. Bantam, 2005).

<sup>13</sup> International Diabetes Federation



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## The Cost of the Health Burden

The nature of obesity, diabetes and, in general, all NCDs means that patients need long-term care, with different degrees of medical intervention, often increasing as the condition evolves and posing significant costs.

Costs can be *direct*, falling on households and governments, or *indirect*, implying a loss of productivity, and ultimately of economic growth. The constantly expanding list of comorbidities that accompanies obesity and diabetes as well as the complexity of the conditions imply that evaluating total costs is challenging. Moreover, it is difficult to compare results between studies, in the absence of a common definition of costs. However, where estimates of *total* costs exist these range between 1%-2% of a country's GDP.<sup>14</sup>

### Direct costs

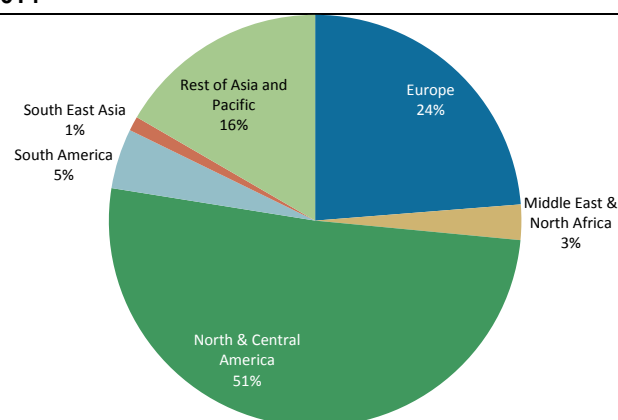
**Direct costs include medications, medical devices and healthcare consultations, the most common of which are for dental diseases.** Tooth decay affects 60%-90% of school-age children and a majority of adults. Great improvements in prevention and treatment have occurred in the last decades, but dental diseases still cost between 5%-10% of health budgets in industrialised countries.<sup>15</sup>

**Other direct costs also include hospitalization for diet-related health conditions and their complications.**<sup>16</sup> Because of the latter, it is difficult to quantify these costs, due to their many ramifications. For example, as well as sharing some of complications already mentioned for overweight and obesity, diabetes can cause retinopathy (which affects the eyes), cardiovascular diseases (heart), nephropathy (kidneys) and neuropathy (nerves and feet up to possible amputations).

The IDF estimates that diabetes-related health expenditure amounted to \$1,060 on average per person in 2014, meaning a total of \$612bn, with large disparities by regions and countries (Exhibit 22). Indeed, more than 80% of the global expenditures are made in the world's richest countries, not in the low and middle countries where the majority of people with diabetes lives. Note that in 2010 the IDF projected that the cost in 2030 would total \$561 billion and we have already surpassed that mark, four years on.

Exhibit 22

### Regional shares of diabetes-related health expenditures, 2014



Source: IDF, Morgan Stanley Research

In the US – which is the country that spends the most on diabetes – direct medical costs are currently estimated at \$172 billion and people with diagnosed diabetes, on average, have medical expenditures approximately 2.3 higher than persons who do not have diabetes.<sup>17</sup>

### Obesity accounts for about 2%-7% of global health care.<sup>18</sup>

The costs related to obesity are even more difficult to quantify than for diabetes, because obesity is not always recorded as the cause for hospitalization. The OECD estimates that these costs are between 1%-3% of total health expenditure in most countries (5%-10% in the US).<sup>19</sup> An analysis by the Health and Social Care Information Centre showed that in England, inpatient hospitals admissions of patients with a primary diagnosis of obesity soared to 11,740 in 2011/12, three times more than recorded five years earlier.<sup>20</sup>

**Depending on individual countries and local social insurance policies, the size of the financial burden will weigh more on private or public finances.** The nearly full universal coverage in most European countries contrasts with the emerging markets where most of the costs are born by the private sector, and where private voluntary insurance is also low (Exhibit 23).

<sup>14</sup> This range is based on studies in the US, UK, the EU and Australia.

<sup>15</sup> WHO - Draft Guideline: Sugars intake for adults and children

<sup>16</sup> These costs include equipment to handle heavier patients.

<sup>17</sup> American Diabetes Association ([American Diabetes Association - The cost of diabetes](#))

<sup>18</sup> WHO

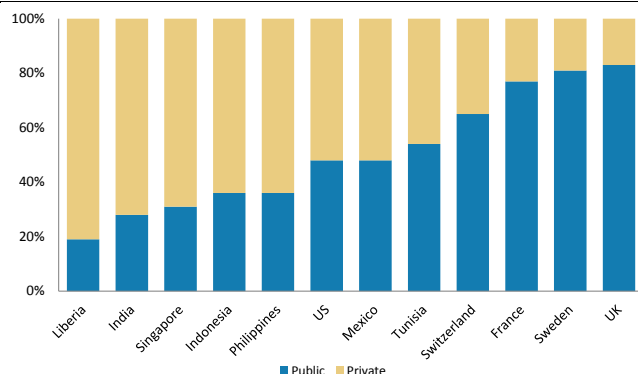
<sup>19</sup> OECD Obesity Updated, June 2014

<sup>20</sup> NHS - [Get serious about obesity or bankrupt the NHS](#)

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Exhibit 23

### Public and private share of total health care expenditure in selected countries



Note: All data are for 2010, except for Mexico (2009).  
Source: The Lancet Global Health 2035 Commission, Morgan Stanley Research

**Finally, among the direct costs, there is also informal care when conditions are not critical.** Even these expenditures are difficult to track: care can be provided in different forms, depending on social expectations about the appropriate place. For example, in some countries family members assist the patients; in others, carers are employed or patients are lodged in nursing homes. Because most people are diagnosed with diabetes at a late stage in life, this poses a further challenge for the care of elderly individuals. In the US, on average, an elderly person receives 6.1 hours per week of informal care, whilst those with diabetes receive between 10.5-14.4 hours per week.<sup>21</sup>

**Informal care may be less expensive for government finances but can put significant strains at household level (especially for low-income families).**

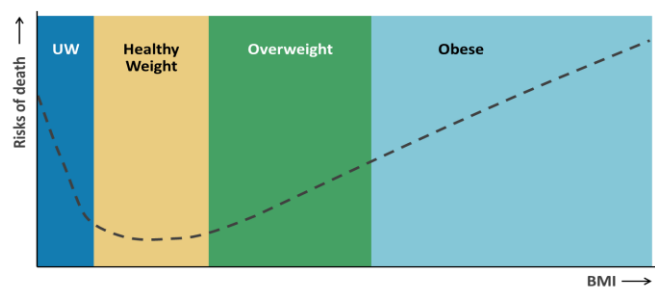
### Indirect costs

**Indirect costs are linked to increased mortality, lost productivity at work and reduced workforce.** Because of the increasing prevalence of diabetes and obesity among young individuals, lower employment and productivity of people with diabetes or obesity are becoming an increasing concern for patients, employers and policymakers. The earlier the onset of the condition, the higher the loss of potential output.

**Premature mortality:** Individuals with obesity and/or diabetes have a shorter life expectancy (Exhibit 24). Premature deaths represent a substantial loss of productive capacity. At present, roughly 50% of the people who die of diabetes is under 60 years of age and, in less-developed regions of sub-Saharan Africa, the share is 75%. Diabetes is currently the 8<sup>th</sup> most common cause of premature death for NCDs and is expected to move to 5<sup>th</sup> in 2030 (Exhibit 25). Moreover, overweight and obesity already cause more deaths than underweight.<sup>22</sup>

Exhibit 24

### Schematic illustration of the association between mortality and BMI for adults



Note: UW Underweight.  
Source: Public Health England, Morgan Stanley Research

More broadly, the WHO projects the number of deaths from NCDs to rise to 73.9% in 2030 from approximately 68% now. Over the same time horizon, in African nations deaths from NCDs are projected to exceed the combined deaths of communicable and nutritional diseases, maternal and perinatal deaths as the most common cause of death.<sup>23</sup>

<sup>21</sup> Kenneth M.Langa et al., Informal Caregiving for Diabetes and Diabetic Complications Among Elderly Americans, Journal of Gerontology, 2002.

<sup>22</sup> It is difficult to track deaths related to obesity as this condition is not often recorded on death certificates, where they exist. The WHO estimates are based on a combination of country life tables, cause of death models, regional cause of death patterns and WHO and UNAIDS programmes estimates for some major causes of death.

<sup>23</sup> [WHO - Noncommunicable diseases](#)

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Exhibit 25

### Number of deaths from NCDs by cause

2015				2030			
Rank	Cause	Deaths (000s)	% deaths	Rank	Cause	Deaths (000s)	% deaths
1	Ischaemic heart disease	7594	13.2	1	Ischaemic heart disease	9245	13.2
2	Stroke	6700	11.7	2	Stroke	8578	12.2
3	Lower respiratory infections	3223	5.6	3	Chronic obstructive pulmonary disease	4568	6.5
4	Chronic obstructive pulmonary disease	3217	5.6	4	Lower respiratory infections	3535	5.0
5	Diarrhoeal diseases	1808	3.2	5	Diabetes mellitus	2464	3.5
6	HIV/AIDS	1667	2.9	6	Trachea, bronchus, lung cancers	2413	3.4
7	Trachea, bronchus, lung cancers	1636	2.9	7	Road injury	1854	2.6
8	Diabetes mellitus	1556	2.7	8	HIV/AIDS	1793	2.6
9	Road injury	1423	2.5	9	Diarrhoeal diseases	1617	2.3
10	Hypertensive heart disease	1137	2.0	10	Hypertensive heart disease	1457	2.1

Source: WHO, Morgan Stanley Research

**Lost productivity at work:** obesity and diabetes can affect labor productivity by diminishing the *intensity* of labour-effort (the amount of output per input), the *quality* of labour effort and, ultimately, the employment/population ratio and labor force participation rates. This is of particular concern in the services sector, which is more labor intensive and where mechanization and automation can provide less of a cushion. Productivity can be lost via two main channels:

- **Absenteeism from work:** this is the reduced productivity due to the time taken off to treat their condition by individuals - who otherwise would be economically active. From a company perspective, this would include also costs of temporary replacement workers, if necessary.
- **Presenteeism at work:** also known as 'sickness presence', the term presenteeism refers to the loss of productivity of employees who report for work when unwell and therefore might have a worse performance compared to normal conditions:<sup>24</sup> in the specific case of obesity, impairments could include reduced dexterity, for example, less mobility or need for more frequent breaks.

**Reduced workforce:** employees may also stop working prematurely, as a result of disease-related-disability, whilst being part of the working-age population: they may experience unemployment, or exit the labor force, in both cases triggering a reduction of earned income and savings.

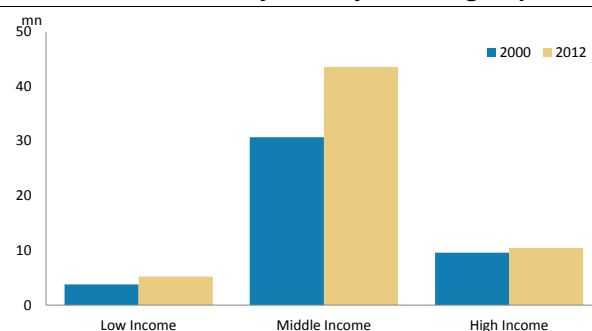
<sup>24</sup> The term 'presenteeism' was originally coined in the 1990s by Professor Cary Cooper, Professor of Organizational Psychology and Health at Manchester University in the UK. Its definition and interpretation have changed over the years but in employment-related medicine literature, it usually refers to employees who go to work even though they are sick. For more information see also <http://www.robertsoncooper.com>.

**The issue has become even more prominent, following the late 2014 European Court of Justice ruling concluding that obesity can be considered a disability.** The ruling is binding across the EU although it is up to national courts to decide which individual levels of obesity can be classified as disability. However, the ruling implies that employers may have to face additional costs to accommodate obese individuals and to facilitate their work.

**The overall disease burden measured by Disability-Adjusted Life Year (DALYs) lost to diabetes is higher in middle income countries and is widening (Exhibit 26).** The DALY, a metric used by the WHO, represents one lost year of 'healthy life'. It is made up of the sum of the years of life lost due to premature mortality in the population and the years lost due to disability for people living with the health conditions or its adverse consequences. For example, the number of DALYs for diabetes alone was nearly 4% of the total DALYs attributable to NCDs in 2012 but, including some of its complications, it could be as high as 35%. Estimates for obesity do not exist because obesity is a risk factor, not an NCD in itself.

Exhibit 26

### DALYs lost to diabetes by country income group



Note: World Bank country income groups.  
Source: WHO, Morgan Stanley Research

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## High Sugar, Low Sugar - The Results of Our Model Simulations

**To provide a sense of how sugar and its effect on diet-related diseases might affect economic growth over the long run we simulated trajectories for selected OECD and BRIICS countries to 2035.** These are not fully fledged forecasts though. Moreover, reflecting the difficulty in modelling the relation between sugar, obesity and diabetes, due to the multitude of factors involved, we acknowledge that the order of magnitude of the outcomes is highly uncertain. However, we believe that the simulations provide a useful tool to identify the sensitivity of the long-run growth outlook of different countries, under various sugar consumption scenarios.

### **Our Base Case Sugar Scenario adjusts long-term OECD forecasts for the impact of sugar consumption on health.**

The long-term OECD forecasts do not include the impact of sugar consumption on health<sup>25</sup>; therefore, on average, across the economy, the output per unit of labour is the same. To calculate our Base Case Sugar Scenario we divide employment into three main categories (healthy, diabetic and obese) and we allow for double counting, because, many obese people develop diabetes.

We then split the diabetic and obese population of working age in three categories: 'absentees', 'presentees' and 'leavers' (those who leave the labor market because they are too ill to work). We base our productivity assumptions on academic evidence of the impact of diabetes and obesity on the workplace which is plentiful, documenting that both conditions are correlated with higher absenteeism and presenteeism. Diabetic and obese individuals are also significantly more likely to retire early than those without diabetes.<sup>26</sup> Specifically, we assume that diabetic people who fall in the absenteeism and presenteeism categories would be 10% and 30% (respectively) less productive than their healthy peers, whilst obese employees would be 20% and 40% less productive.

**In our Base Case Sugar Scenario we assume no change in the propensity to consume sugar compared to current levels and no changes in prices.** We used the IDF's diabetes 2035 forecasts in this scenario (because the IDF does not make specific assumptions about per capita sugar consumption). The number of obese individuals (BMI=> 35)

are Morgan Stanley's estimates based on the work of Stevens et al.<sup>27</sup>

### **We also run a 'High Sugar' simulation and a 'Low Sugar' simulation.**

In our High Sugar Scenario we allow for an increase of sugar preference of 5kg per person cumulatively over the projection-horizon (this is equivalent to a sustained increase/decrease of about 50kcalories per person per day). In the Low Sugar Scenario we assume a drop in sugar consumption of 10kg per person (equivalent to a reduction of around 100kcal per person per day).

### **Finally, we calculate the impact that these sugar changes have on diabetes and obesity prevalence.**

We use academic evidence on the link between sugar and diabetes and the impact that higher energy intakes have on countries' mean BMIs. Specifically, for diabetes, we use the following equivalence: 150kcal/person/day increase in sugar availability boosts diabetes prevalence by 1.1%. For obesity we use the following equivalence: 100kj per day (20kcal per day) lead to an eventual body change of about 1kg in about 3 years.<sup>28</sup>

**The results show that in our Base Case Sugar Scenario, GDP growth averages 1.8% annually in the OECD area over the next 20 years, compared with the OECD forecast of 2.3% (that is a cumulative loss of 18.2 percentage points over the next twenty years).** (Exhibit 27)

**OECD forecasts:** These are long-term forecasts. They do not include the impact of sugar consumption on health; the output per unit of labor is the same across the economy.

**Base Case Sugar:** We use the OECD forecasts as a starting point and adjust them for our assumptions on the different productivity levels of healthy, obese and diabetic individuals.

**High Sugar/Low Sugar:** We take our Base Case Sugar Scenario and assume changes in sugar preference.

<sup>25</sup> Economic Outlook No 95 – May 2014.

<sup>26</sup> See for example, Marie Claude Breton et al, Burden of Diabetes on the Ability to Work, A systematic review, American Diabetes Association, 2013.

<sup>27</sup> These are Morgan Stanley Research estimates assuming that the recent trend in obesity growth, as measured by Steven et al, is sustained to 2035 in the countries which we analysed. For more information see Stevens et al.: National, regional, and global trends in adult overweight and obesity prevalences, Population Health Metrics, 2012.

<sup>28</sup> See Basu S, Yoffe P, Hills N, Lustig RH (2013) The Relationship of Sugar to Population-Level Diabetes Prevalence: An Econometric Analysis of Repeated Cross-Sectional Data. PLoS ONE 8(2): e57873. doi:10.1371/journal.pone.0057873 and Kevin D Hall et al, Quantification of the effect of energy imbalance on bodyweight, The Lancet, August 2011.

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Exhibit 27

### Summary results: annual real GDP growth in our Base Case Sugar Scenario versus OECD forecasts, 2015-2035

Country	Real GDP		Productivity	
	OECD Long-term Forecasts	Base Case Sugar Scenario	OECD Long-term Forecasts	Base Case Sugar Scenario
OECD	2.3%	1.8%	1.9%	1.5%
Australia	3.2%	2.7%	2.1%	1.7%
Canada	2.1%	1.5%	1.3%	0.9%
Chile	4.1%	3.3%	3.4%	2.9%
France	2.3%	1.9%	1.9%	1.7%
Germany	1.1%	0.4%	1.3%	0.9%
Greece	3.1%	2.5%	3.0%	2.6%
Hungary	1.9%	1.2%	2.1%	1.6%
Israel	3.1%	2.5%	1.8%	1.4%
Italy	1.9%	1.5%	1.7%	1.4%
Japan	1.1%	0.9%	1.5%	1.4%
Korea	2.7%	2.5%	2.4%	2.3%
Mexico	3.1%	2.4%	2.2%	1.8%
Netherlands	2.3%	1.8%	2.1%	1.7%
New Zealand	2.5%	1.9%	1.7%	1.3%
Norway	2.3%	1.8%	1.5%	1.1%
Poland	2.0%	1.3%	2.2%	1.7%
Portugal	2.1%	1.5%	2.1%	1.6%
Spain	1.9%	1.2%	1.5%	1.0%
Sweden	2.5%	2.1%	2.0%	1.7%
Switzerland	2.1%	1.8%	1.6%	1.3%
Turkey	4.2%	3.7%	3.4%	3.1%
United Kingdom	2.6%	2.0%	2.1%	1.6%
United States	2.5%	1.8%	1.8%	1.3%
<b>BRICS</b>	<b>4.5%</b>	<b>4.2%</b>	<b>4.0%</b>	<b>3.8%</b>
Brazil	2.6%	2.0%	2.1%	1.7%
China	4.5%	4.1%	4.3%	4.1%
India	5.7%	5.6%	4.8%	4.7%
Indonesia	5.2%	5.1%	4.3%	4.2%
Russia	2.8%	2.0%	3.2%	2.6%
South Africa	4.6%	3.8%	4.0%	3.5%

The OECD forecasts do not include the impact of sugar consumption on health. In our Base Case Sugar Scenario we use the OECD forecasts as a starting point and adjust them for our assumptions on the different productivity levels of healthy, diabetic and obese individuals. Source: OECD, Morgan Stanley Research estimates

**The largest output loss are recorded in Chile, followed by the Czech Republic, Mexico, US, Australia and New Zealand.** These countries all suffer from double-digit diabetes prevalence and have among the highest rates of obesity globally (Exhibit 28). In addition, 12 more countries show above OECD average losses. Altogether they account for 60% of the OECD area.

**In contrast, Japan, Korea, Switzerland, France and Italy are among the countries with the smallest losses.**

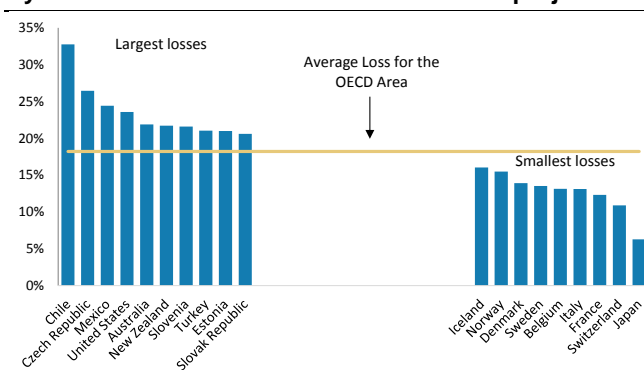
Traditionally diets in Japan and Korea are not sugar rich and Korea is also a good example of how via a mix of education campaigns and social marketing the country has managed to preserve its traditional vegetable-rich diet.<sup>29</sup> As a result, both countries have relatively low diabetes and obesity rates. France and Italy compared well for the same reasons (their obesity and diabetes rates are lower even by European standards). The case of Switzerland is interesting because, despite having one of the highest sugar-per-capita consumption in the world, its diabetes and obesity rates are

<sup>29</sup> Sharada Keats and Steve Wiggins, Future Diets, Implications for Agriculture and Food Prices, Overseas Development Institute, January 2014.

relatively low, partly due to comparatively high physical activity than in other countries.<sup>30</sup>

Exhibit 28

### Base Case Sugar: top and bottom ten countries ranked by cumulative loss of real GDP vs OECD LT projections



Note: the data shown are percentage points. LT long-term. Source: Morgan Stanley Research estimates

**Among the BRICS countries South Africa and Russia stand out as the countries with the largest cumulative loss of real GDP versus the OECD projections (of 38.3 and 27 percentage points, respectively) (Exhibit 29).**

**In contrast, Asian countries (China, India and Indonesia) perform better.** Their cumulative growth loss is relatively lower, because despite having high diabetes rates by international standards, their obesity prevalence is relatively low.

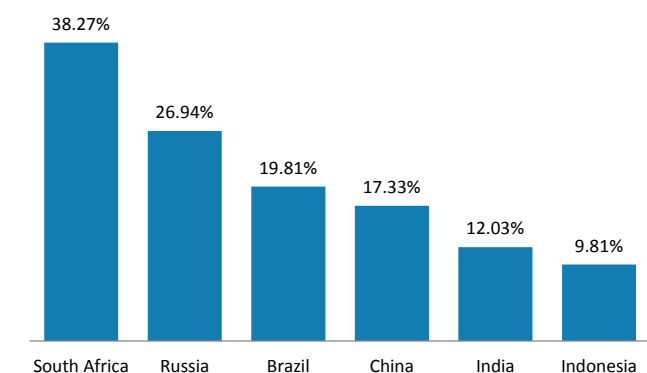
**This should be no excuse for complacency though.** In these countries, relatively higher diabetes rates are largely due to genetics - as well as environmental influences; thus, preventing a rise in obesity to Western standards is even more urgent because the onset of diabetes can be triggered by much smaller weight gains than in DM. Moreover, the young age of the onset of the disease may increase long-term costs, by boosting the risk of premature mortality and diabetic complications.

<sup>30</sup> According to the Health Enhancing Physical Activity Authority for Switzerland, some 65% of the population aged 15 or over engage in sufficient physical activity (see [www.hepa.ch](http://www.hepa.ch)).

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Exhibit 29

### Base Case Sugar: cumulative loss of real GDP for BRIICS countries versus OECD long-term projections

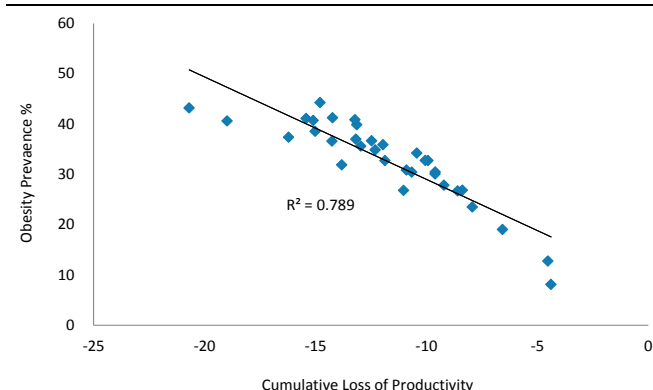


Note: the data represent percentage points.  
Source: Morgan Stanley Research estimates

**In the Base Case Sugar Scenario productivity growth in the OECD region averages 1.5% annually over the next 20 years vs. the 1.9% OECD forecast.** This would result in a cumulative 11.7 percentage points over the projection horizon, which is not surprising given the strong negative correlation between the countries that report the largest losses and their obesity rate (Exhibit 30). Among the BRIICS, productivity growth would average 3.8% annually, with a cumulative loss of 8.7 percentage points compared to the OECD long-term forecasts.

Exhibit 30

### Base Case Sugar Scenario: OECD countries' cumulative loss of productivity growth versus obesity rates



Source: Morgan Stanley Research estimates

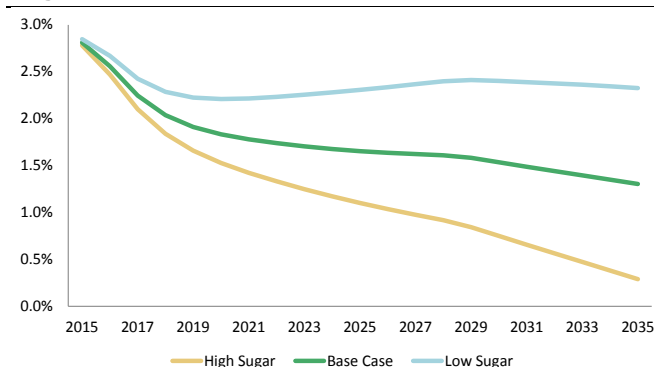
**These simulations are quite sensitive to the assumptions about productivity levels of diabetic and obese cohorts.** For example, assuming that both would be half as productive as their healthy peers, adjusted OECD GDP growth would

average 1.5%Y, adding a further 4 percentage points to the loss of real GDP growth over the projection horizon compared to the Base Case Sugar scenario. Similarly, the distribution of diabetic and obese individuals among absenteeism, presenteeism and leavers can have quite a high impact on the growth outcome, especially the share of those leaving the work force (as they represent a 100% loss of potential capacity). Importantly, whilst we have applied the same rate of absenteeism and presenteeism to all countries under consideration, in practice these rates can vary across countries, reflecting differences in social security coverage, in terms of granting sick leave or unemployment benefits.

**In the High Sugar Scenario, OECD area growth would slow to 1.3%Y, approaching 0.3% towards the end of the projection horizon (Exhibit 31).** This is because diabetes prevalence would increase to 12.0% from 11.6% in the base case scenario, whilst obesity prevalence would nearly double to 60%.<sup>31</sup> **Chile** still tops the list in terms of growth loss compared to the Base Case Sugar Scenario, followed by **Turkey, Mexico, Australia and the United States**, reflecting their relatively high sugar preference as well as diabetes and obesity rates (Exhibit 32).

Exhibit 31

### OECD area annual real GDP growth adjusted for our three Sugar Scenarios



Source: Morgan Stanley Research estimates

**Countries that would lose most in the High Sugar Scenario would also benefit most in the Low Sugar Scenario.** On average OECD GDP growth would be 2.2% annually in the Low Sugar Scenario, levelling off around that pace by 2035. In this scenario, the OECD diabetes rate would fall to 10.9% and the obesity rate would head towards zero (Exhibit 32 again).

<sup>31</sup> The large discrepancy between the scale of the change of diabetes and the obesity rate changes is because the latter is related to the increase in mean BMI resulting from higher sugar consumption via a quadratic function, instead of a linear function, in line with the findings of WHO's 'Comparative Quantification of Health Risks' (2000, pages 21-24).



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Exhibit 32

**Summary results: average annual real GDP growth in the Base Case, High and Low Sugar Scenarios 2015-2035**

Region/Country	High Sugar Scenario	Base Case Sugar Scenario	Low Sugar Scenario
<b>OECD</b>	<b>1.3%</b>	<b>1.8%</b>	<b>2.2%</b>
Australia	2.2%	2.7%	3.2%
Canada	1.0%	1.5%	2.0%
France	1.5%	1.9%	2.3%
Germany	-0.2%	0.4%	1.0%
Greece	2.0%	2.5%	3.0%
Ireland	1.6%	2.1%	2.7%
Israel	2.1%	2.5%	3.0%
Italy	1.1%	1.5%	1.9%
Japan	0.6%	0.9%	1.0%
Korea	2.1%	2.5%	2.7%
Mexico	1.9%	2.4%	3.0%
New Zealand	1.3%	1.9%	2.4%
Norway	1.3%	1.8%	2.2%
Poland	0.8%	1.3%	1.9%
Portugal	0.9%	1.5%	2.0%
Spain	0.6%	1.2%	1.8%
Sweden	1.7%	2.1%	2.5%
Switzerland	1.3%	1.8%	2.1%
Turkey	3.3%	3.7%	4.2%
United Kingdom	1.5%	2.0%	2.6%
United States	1.2%	1.8%	2.4%
<b>BRIICS</b>	<b>3.9%</b>	<b>4.2%</b>	<b>4.4%</b>
Brazil	1.5%	2.0%	2.6%
China	3.8%	4.1%	4.3%
India	5.3%	5.6%	5.6%
Indonesia	4.8%	5.1%	5.2%
Russia	1.4%	2.0%	2.7%
South Africa	3.3%	3.8%	4.4%

The OECD forecasts do not include the impact of sugar consumption on health. In our Base Case Sugar Scenario we use the OECD forecasts as a starting point and adjust them for our assumptions on the different productivity levels of healthy, diabetic and obese individuals. In the high- and low-sugar scenarios we assume different levels of sugar consumption per capita which are detailed in the text.

Source: Morgan Stanley Research estimates

**In the BRIICS area, GDP expands by 3.9% annually and 4.4%, respectively, in the High and Low Sugar Scenarios.** Brazil, Russia and South Africa are the countries that would suffer/benefit the most in each scenario. Diabetes prevalence would fall on average to 10.6% and the obesity rate would go to zero.

**Our simulations do not suggest that a reduction of 10kg in per capita sugar consumption would abate obesity.** In the Low Sugar Scenario, many individuals would shift from the 'obese' category into 'overweight' and thus still remain at high risk of NCDs.

**Nevertheless, the results highlight that, all else being equal, even modest adjustments to sugar consumption patterns, if *sustained*, can achieve long-term benefits.** To put things in perspective, the much demonized sweetened can of full-calorie soda (330ml) provides 39g of sugar per unit and about 140kcal (9-10 teaspoons). If consumed daily, this implies 14kg of sugar intake per year, which - assuming no calorie burning activity from physical exercise - can add about 6-7kg to an individual weight, over a three year period.

**Understanding sugar contribution to calorie imbalance is key to reverse ongoing trends in obesity and diabetes.**

Indeed, medical research has proved that, if caught at the onset, diabetes Type 2 can be reversed by weight loss which returns insulin secretion to normal levels.<sup>32</sup>

We are happy to go into more granularity and more analysis by country upon request.

<sup>32</sup> See 'Reversing Type 2 Diabetes', New Castle University [NCL - Reversing Type 2 Diabetes](#)



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## Different Sugar Consumption Tracks for DM/EM

Looking at sugar consumption developments and diet-related diseases three factors stand out:

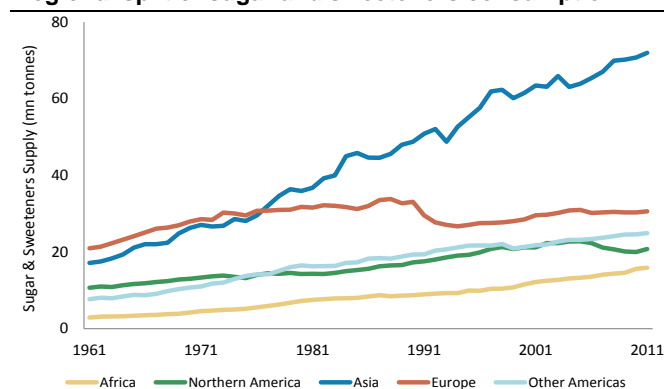
- 1) **There is burgeoning evidence in the developed markets that sugar consumption is beginning to decline, whilst it will continue to increase in emerging markets** in coming decades, driven by population trends and rising sugar preference.
- 2) **Overweight (including obesity) is stabilizing in some developed countries** where the debate about diet-related diseases has heightened recently.
- 3) **Diabetes and obesity are no longer a problem of wealthy countries, or only of adults**; what is changing is that the majority of people who are diabetic or obese are now in the developing, rather than in the developed world. Moreover, the conditions are escalating among children and adolescents.

### Diverging Sugar Demand Trends

**Globally, sugar and sweeteners consumption is slowing.** After expanding by ~3.7%Y in the 1960s and ~2.5%Y in 1970s, growth of sugar and sweeteners moderated to ~2%Y in the 1980s and has steadied at ~1%Y from the 1990s onwards.

Exhibit 33

#### Regional split of sugar and sweeteners consumption



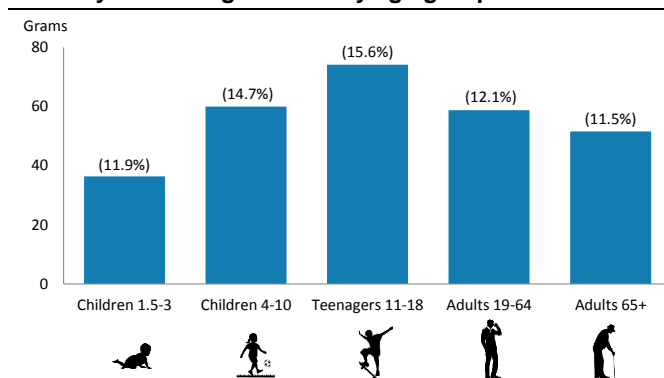
Source: FAO, Morgan Stanley Research

**This trend is likely to continue, as diverging population trends impact sugar demand in the developed and in the emerging world differently.** Growing population will boost sugar demand in developing countries whilst ageing

population, especially in more mature and saturated sugar markets, will pull in the opposition direction in the developed world (Exhibit 33). Much attention has been devoted to the impact that rising population will have on agricultural resources and supply but there has not been much focus on decreasing energy need in the populations that are ageing. Indeed, as people age, their metabolism slows and hence the need for calories is reduced. In fact, sugar consumption tends to be comparatively high among children and teenagers (Exhibit 34).

Exhibit 34

#### UK daily added sugar intake by age groups



Note: Percentage of daily food energy from added sugars shown in brackets.  
Source: UK 2008-12 National Diet & Nutrition Survey, Morgan Stanley Research

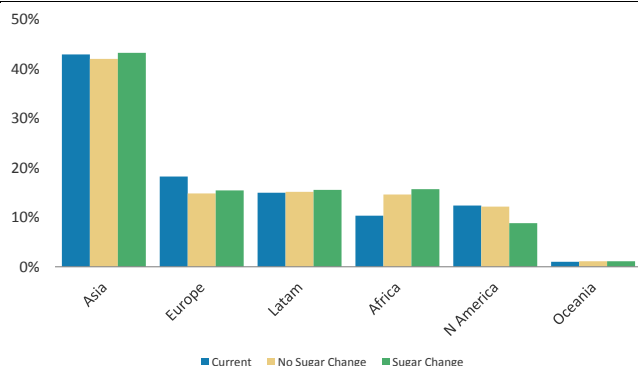
**We investigate the potential impact of population dynamics and changes in propensity to consume sugar on regional sugar demand.** In our first scenario we assume no change in sugar preference until 2035 - i.e. no change in consumption per person compared to current levels, in practice isolating the impact of population dynamics on sugar demand. Our second scenario uses the same population projections but assumes that the regional increase/decrease observed in the ten years to 2011 are sustained until 2035.<sup>33</sup>

<sup>33</sup> We use the UN 2012 population projections (medium fertility rate).

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Exhibit 35

### Regional share of global sugar consumption in 2035 under different scenarios



The 'No Sugar Change' scenario isolates the impact of population dynamics on sugar demand. The 'Sugar Change' scenario assumes that the regional increase/decrease observed in 2001-2011 are sustained until 2035.  
Source: FAO, Morgan Stanley Research

**Africa, Central and Latin America stand out when comparing the regional share of sugar consumption with increases under both simulated scenarios.** In these regions sugar demand would grow because of population trends and would rise even further because of increasing sugar propensity, if recent changes are sustained (Exhibit 35).

**North America and Europe are at the other extreme.** The populations are ageing and per capita consumption of sugar has recently been dropping in both areas. Therefore, sugar demand would contract under both scenarios. In Europe, however, the 'sugar change' scenario is marginally higher than the 'no sugar change' one, because of the rising sugar preference in Eastern Europe.

**Asia shows a mixed pattern.** If it were only for population trends, sugar demand would drop - largely reflecting the ageing of the population in China and in Japan - but would rise in second scenario because of the ongoing shift to a higher-sugar diet.

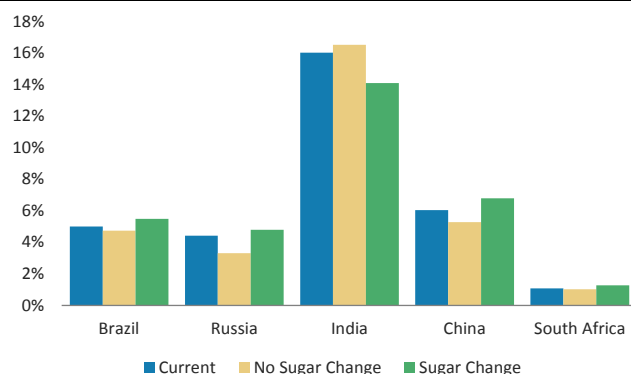
**In Oceania, the share of sugar consumption would remain roughly steady under both scenarios.**

**Within each region there are also differences.** Within Africa, the share of sugar consumption would rise in both scenarios in all its sub-regions, bar Southern Africa (where population trends point to a reduction). The picture is opposite, but similarly consistent, in Europe (where sugar demand in all sub-regions would drop in both scenarios, bar in Eastern Europe). An analysis of the BRIICS countries reveals

a mixed pattern, with population trends pointing to a reduction of the share of sugar consumption in all countries but India (Exhibit 36).

Exhibit 36

### BRIICS' share of global sugar consumption in 2035 under different scenarios



The 'No Sugar Change' scenario isolates the impact of population dynamics on sugar demand. The 'Sugar Change' scenario assumes that the regional increase/decreases observed in 2001-2011 are sustained until 2035.  
Source: FAO, Morgan Stanley Research

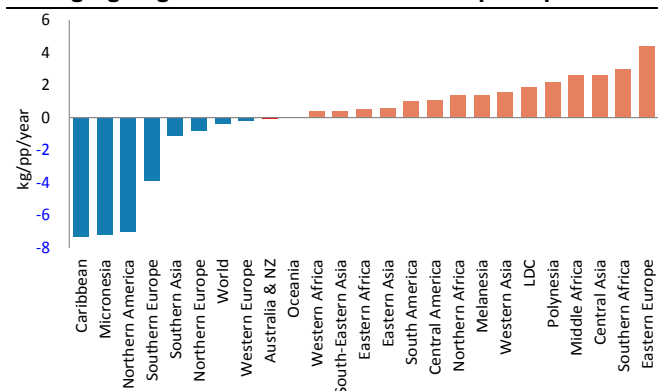
### Narrowing Differences in Sugar Consumption...

**Measured per capita, global sugar consumption shrank by 0.4kg in 2001-2011, with marked contractions in DMs.** This is particularly notable in North America, selected regions of Europe and to a lesser extent Australia and New Zealand. Contractions were also pronounced in the Caribbean and in Micronesia, all areas experiencing extremely high obesity prevalence. In contrast, developing countries as a group, with their increasing dominant share of world sugar consumption, recorded gains (particularly large in Eastern Europe, China, Guatemala, Thailand and Russia) (Exhibit 37).

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Exhibit 37

### Changing sugar and sweeteners consumption patterns



The bars show the regional changes in sugar and sweeteners consumption per capita in 2001-2011.

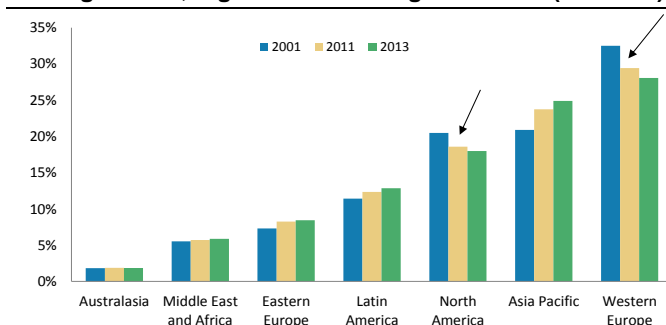
Source: FAO, Morgan Stanley Research

### Our findings are corroborated by data on packaged food - market share is increasing in EM and declining in DM.

Processed food (where sugar is usually hidden), shows declines in the market shares accounted for by Western Europe and North America and gains in Eastern Europe, Latin America and Asia Pacific (Exhibit 38 and 39). In terms of sales growth (volumes), since 2001 the largest gains were recorded by China, Argentina, Vietnam, Indonesia, India and UAE: here rates exceeded significantly the global average growth of 2.2%Y, whilst growth stagnated (Japan) or was very muted in the US and selected European countries. Moreover, global sales of reduced-sugar packaged food are gaining momentum, albeit remaining still a niche market.

Exhibit 38

### Packaged food, regional shares of global sales (volumes)



Source: Euromonitor, Morgan Stanley Research

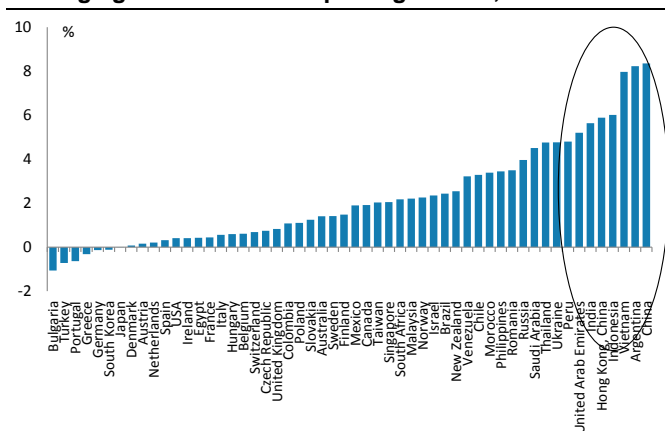
### Furthermore, sales volumes of carbonated drinks have declined in the developed world. These drinks have

recently received much negative press for causing obesity and metabolic syndrome. Sales are down since 2005 in the US and since 2009 in Western Europe. Americans are now

drinking about 450 cans of soda a year, according to Beverage Digest, roughly the same amount they did in 1986. In contrast, sales of carbonated drinks have increased significantly in Latin America and in the Asia Pacific regions since mid-2000 and have recently edged up in the Middle East and Africa, more than offsetting the declines in developed markets. As a result, total sale volumes of carbonated drinks (including regular and reduced-sugar) are still trending upwards led by emerging markets.

Exhibit 39

### Average growth of sales of packaged food, 2001-2013



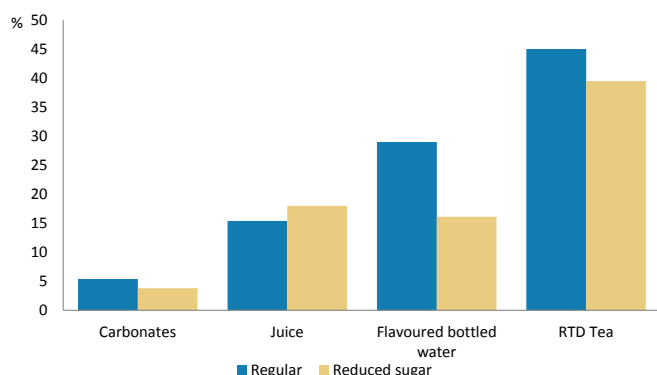
Source: Euromonitor, Morgan Stanley Research

At the same time, signs are increasing that consumers are shifting their preference towards drinks that are perceived to be healthier. Exhibit 40 shows that growth of sales of juices, flavoured bottled water and 'ready to drink' teas have outpaced significantly growth of carbonated drinks in 2008-2013. Furthermore, growth of reduced-sugar fruit juices has been faster than that of regular ones, providing additional evidence that the health/weight concerns are beginning to resonate with the general public.

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Exhibit 40

### Global sales of reduced-sugar and regular soft drinks by category, 2008-2013 (volumes)



RTD Ready to Drink

Source: Euromonitor, Morgan Stanley Research

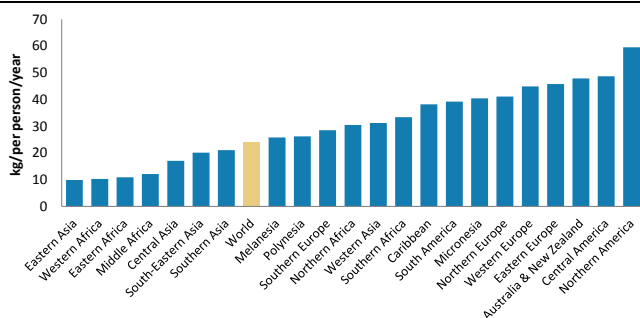
### ...But Probably Not Converging

**Will EMs, where sugar preferences are rising, converge to an international 'Western' norm? Probably not.** Income is not the only determinant of sugar demand and its explanatory power may be weakening.

**Income remains an important determinant of sugar demand.** In developed countries, sugar consumption (around 45 kg/pp) is 3 times that of the developing countries (around 15 kg/pp) (Exhibit 41).

Exhibit 41

### Sugar and sweeteners per capita consumption by region



Source: FAO, Morgan Stanley Research

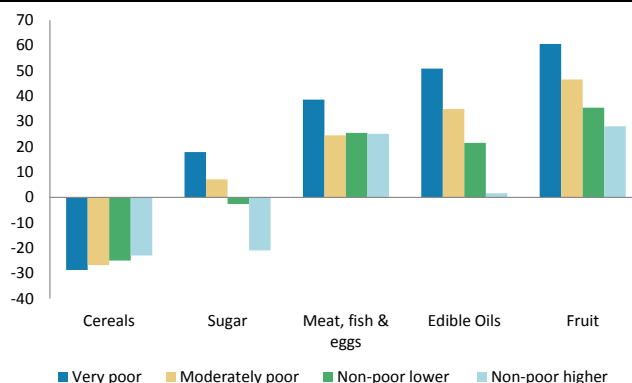
**Rising incomes are accompanied by increasing urbanization with huge repercussions on sugar demand, diets in general and lifestyles.** Urban residents are more affluent than rural ones; have greater access to convenience food; generally consume more refined carbohydrates, processed food, fats and have a lower fiber intake. Increased women's labor force participation has also boosted consumption of ready-made meals.

**Urbanization encourages a more sedentary life.** Longer hours are spent at work with less physical effort to reach the workplace. Sedentary activities during leisure time have increased, including watching TV and, more recently, spending time on electronic devices. Indeed, according to eMarketer, last year, time spent with digital media among US adults surpassed time spent with TV for the first time.<sup>34</sup> Importantly, numbers are set to grow fast in emerging markets where broadband accounts are increasing rapidly and time spent with TV will rise significantly, as suggested by fast pay-TV penetration (which, at more than 30% of households is well behind the 60% rate in developed markets).<sup>35</sup> Time spent with TV or digital devices, encourages snacking, irregular eating patterns and penalizes home-made meals.

**However, income's explanatory power of sugar consumption may be weakening.** Single countries' relationship between sugar consumption and income is not always statistically significant. This may partly be attributable to the fact that country data are probably not of equal quality or that more data analysis is required to account for disparity in income distributions within a country. For example, a recent study on India shows that in the twenty years to 2004, there was a mixed trend in the budgetary allocation to sugar (as a share of total food expenditure) by income group (Exhibit 42). This contrasts with the pattern observed for other food commodities, which have experienced more consistent changes.

Exhibit 42

### India's example is a reminder that sugar is a 'special' kind of staple



The bars show changes in India's budgetary shares of different food commodities in total food expenditure by income group, 1983-2004.

Source: Morgan Stanley Research based on Praduman Kumar et al. 'Estimation of Demand Elasticity for Food Commodities in India', Agricultural Economics Research Review, 2011

<sup>34</sup> eMarketer - Mobile Continues to Steal Share of US Adults Daily Time Spent with Media.  
<sup>35</sup> Pyramid Research

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**The largest increases in sugar consumption per unit of GDP occur for middle-income countries.** However, they are not statistically significant for low- and high-income countries (Exhibit 43).

Exhibit 43

### Elasticity of consumption of selected staples to income

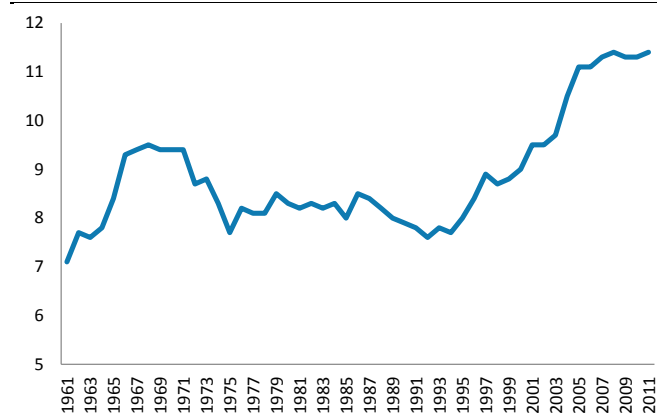
GDP per Capita Level		Sugar		Meat		Cereal	
		Coefficient	R <sup>2</sup>	Coefficient	R <sup>2</sup>	Coefficient	R <sup>2</sup>
Low		0.375	0.046	-0.150	0.008	0.239	0.040
Medium		0.459***	0.274	0.585***	0.330	-0.024	0.003
High		0.099	0.021	0.146*	0.039	0.022	0.001

\*\*\* p<0.001, \* p<0.05. WHO definition of low-, medium- and high-income countries. Cross-country analysis was conducted using 168 countries.  
Source: Morgan Stanley Research

**Moreover, the shift to a higher-sugar diet now appears to occur at lower GDP levels than previously and probably has been accelerated by increasing globalization and food availability.**<sup>36</sup> This may explain why sugar consumption has risen rapidly even among the poorest nations since the 1990s (Exhibit 44). It could also partly explain why lower-income consumers within rich nations consume more fat- and sugar-rich diets than higher-income consumers.

Exhibit 44

### Sugar and sweeteners consumption in least developed countries has increased by ~50% since the early 1990s



The data show kg/per capita/year.  
Source: FAO, Morgan Stanley Research

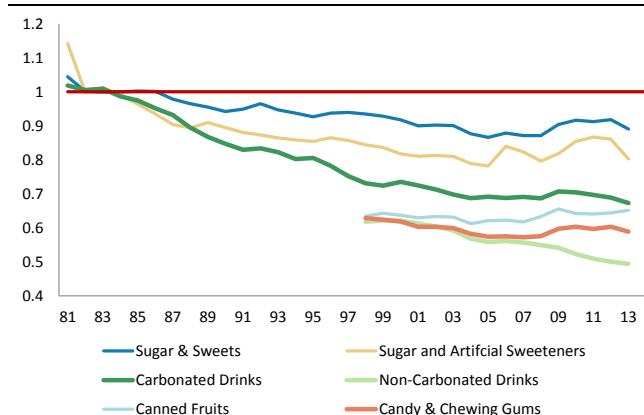
**The globalization of diets works through various channels.** For example, via increasing trade, countries can import new food products or cheaper foods that are already part of their diets (from the mid-1970s to the mid-2000s world sugar prices fell by 82% in real terms, leading to falling real prices on domestic markets). Furthermore, multinationals

companies have invested in food processing and retailing in many emerging middle-income economies, broadening food choice. Mexico is frequently cited as an example, where following the North American Free Trade Agreement (NAFTA) – which boosted US investment in Mexican processing and retailing from the early 1990s – there has been a shocking increase in demand for fats, refined carbohydrates and soft drinks (and, incidentally of type-2 diabetes and obesity). A recent WHO study confirmed that countries adopting 'market-liberal' policies experience faster increases in both fast food consumption and body mass index.<sup>37</sup> Finally, increased media penetration has broadened the information flow, and contributed to promote 'western-style' standards, especially via advertising.

**Prices are also playing a role.** The affordability of sugar stems not just from income but also from prices. One of the factors which may have boosted consumption of products with added sugar in recent years is that they are cheaper than other types of food. Exhibit 45 shows that US high-sugar products rose much less than overall consumer food prices over the past three decades, for example. Research has demonstrated that thanks to falling real sugar prices and technological advances, the energy cost of sucrose (i.e. its cost per calorie) is relatively low, therefore concluding that, for this reason, diets of low-income consumers may be high in sugars and fats.<sup>38</sup>

Exhibit 45

### US sugar and high-sugar-content product relative prices



Note: when the lines are below one it means that prices increase less than the overall food price index; data before 1998 are not available for canned fruits, non-carbonated drinks, candy and chewing gums.  
Source: BLS, Morgan Stanley Research

<sup>36</sup> Adam Drewnowski, Fat and Sugar: An Economic Analysis, American society for Nutritional Science, 2003.

<sup>37</sup> Roberto De Vogli et al., The Influence of market deregulation on fast food consumption and body mass index: a cross-national time series analysis, Bulletin of the WHO, September 2013.

<sup>38</sup> A. Drewnowski, Op.cit.

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However, more recently, it has also been argued that sugary product prices are not cheaper but are *perceived* to be so. This is because when measured on the basis of edible weight or average portion size, 'healthy' food is cheaper than foods that are high in saturated fat, sodium or added sugar. For instance, soft drinks have a lower price per calorie than milk (because they provide a higher caloric intake) but when measured per average-size portion (usually twice as much as milk) they are more expensive and may be also less satiating (Sugar Cube 2 Box).<sup>39</sup>

#### SUGAR CUBE #2: LEPTIN RESISTANCE

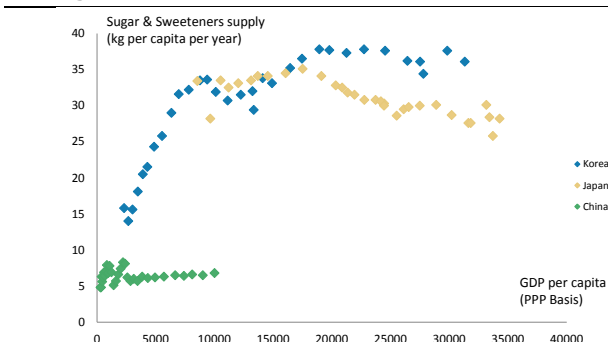
Satiety is a complex process, which is partly regulated by leptin, a hormone providing the nervous system with 'feed-back' information, inhibiting hunger when the amount of fat stored in the body reaches a certain level. Thus, it plays an important role in regulating appetite, food intake and the lipid metabolism. Since the mid-1990s it has become clearer that the body metabolizes sugar in different ways, and that fructose in particular can act as a leptin inhibitor, eventually triggering resistance. Fructose can stimulate weight gain because of its effects on appetite and by blocking the burning of fat. Furthermore, for the same level of caloric intake, it generates more fat in the liver, compared to other types of sugar. Naturally, fruits have fructose (in fact their intake is limited in weight-management programs); but they also contain other nutrients (such as vitamins, fibers) and antioxidants. Instead, processed food, which is high in fructose (particularly soft drinks) has been increasingly blamed for leptin resistance, which is common in diabetic, overweight and obese individuals.

**Local diets and culture are important.** The diversity of individual countries' sugar demand (and diets in general) within a geographical region is remarkable as are the differences in trajectories over time. This suggests local culture and preferences are also important drivers of sugar demand.

**In Asia, for the same level of per capita GDP, Chinese consumption of sugar and sweeteners is way below that of Japan or Korea.** See Exhibit 46 Traditionally, desserts do not feature prominently in the Chinese diet and they are normally consumed when entertaining company or on special occasions. Ice creams and baked goods have also, until recently, not been very popular because of lack of appliances. Moreover, anecdotal evidence suggests that awareness about healthy-living styles is increasing in China.

Exhibit 46

**In China rising wealth appears to have had little impact on sugar and sweeteners consumption so far**

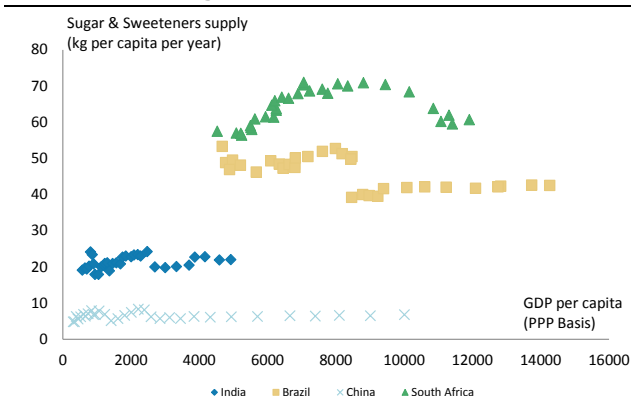


The data show sugar and sweeteners supply versus GDP per capita.  
Source: FAO, World Bank, Morgan Stanley Research

**When comparing BRIICS countries, sugar demand appears to be relatively inelastic to income in China and India; however, the *level* of consumption is higher in India because the country has a higher propensity to consumer sugar** (Exhibit 47). In very poor, rural areas, Indian people consume large quantities of unrefined sugar (jiggery with chapatis – unleavened bread). As they get richer consumption of locally produced biscuits and sweets increases before moving to premium brands of sugary products as they become more affluent.

Exhibit 47

**For the same level of wealth, selected BRIICS countries have different sugar preferences**



The data show sugar and sweeteners supply versus GDP per capita.  
Source: FAO, World Bank, Morgan Stanley Research

**Cultural influences can also drive sugar demand: South Africa and some Pacific islands are good examples.** In addition to the increasing 'Westernisation' of dietary preferences, a highly calorific diet is not perceived negatively because of its repercussions on the body shape. Being

<sup>39</sup> Andrea Carlson, and Elizabeth Frazão, Are Healthy Foods Really More Expensive? It Depends on How You Measure the Price, EIB-96, U.S. Department of Agriculture, Economic Research Service, Economic Information Bulletin Number 96, 2012.



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overweight may have a positive social connotation, as it is a sign of wellbeing and lack of diseases. Indeed, a study by the Human Sciences Research Council found that 88% of South Africans regard a fat body as their ideal. Also, in some Pacific Islands a large body size is associated with wealth and power. Therefore, high sugar consumption can help achieve social status.

**Social factors may influence sugar consumption.** For example, it has been suggested that even relative isolation or perceived loneliness can be associated with high intake of sugary beverages. Having a supportive family and friendly environment or a sense of togetherness at work have been associated with lower consumption of sugar-containing beverages.<sup>40</sup>

**Finally, the propensity to sugar consumption may also depend on genetics.** Recent research found populations that live at Northern latitudes carry a variation in a sugar-sensing gene that allows them to detect trace levels of sweetness more frequently than tropical living people and therefore are more sugar prone. In other words, our ability to detect sweetness depends not only on the taste receptors occupying our taste buds but also on our genetic code. It is not clear when the genetic mutation occurred but one possible explanation is that people in Northern climates had less access to carbohydrate-rich vegetation, and, therefore, they may have developed a higher sensitivity to sugar at low concentrations.<sup>41</sup>

**In summary, local preferences and national/regional factors suggest that countries' trajectories are not pre-ordained and may not converge to a single international norm.** Demographics, rising incomes, prices and the various influences of globalization point to further sizable gains in sugar demand by emerging markets in coming decades. Nevertheless, consumption will likely not reach the levels of the 'Western' world, because of local factors. Moreover, increasing concerns about obesity and metabolic syndrome diseases will probably act as further headwinds.

<sup>40</sup> Henriksen RE, Torsheim T, Thuen F (2014) Loneliness, Social Integration and Consumption of Sugar-Containing Beverages: Testing the Social Baseline Theory. PLoS ONE 9(8): e104421.

<sup>41</sup> [NIH - How Sensitive to Sweet Are You?](#)



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## Different Health Patterns for DM/EM

**Measuring and monitoring overweight and obesity is not easy.** For a start, statistics are not periodic in the majority of countries. In addition, many measurements are based on households' surveys, which are often biased downwards, because respondents want to portray a positive image of themselves in their replies. Finally, international comparisons are challenging because of differences in sampling. While data are abundant in a few countries (such as the US, UK and Australia), efforts to respond to the paucity of information are only just increasing. The EU has recently introduced a European health interview survey (EHIS) that aims to measure on a harmonised basis the health status, life style and health care services use of EU citizens. Moreover, the WHO voluntary target to stop the rise in obesity by 2025 – as part of the Global Non-Communicable Disease (NCD) Action Plan 2013-2020 – should encourage countries 'to get the basics in place'.<sup>42</sup>

**The rate of increase in overweight and obesity is slowing but not reversing in the developed countries.** No country has seen a reversal of the trend in the obesity epidemic since it began in the 1980s. However, the rate of increase of overweight and obesity has slowed in developed countries in recent years, echoing the findings on sugar consumption. Admittedly, some of the recent slowdown could be due to base-year effects. According to the OECD, overweight (including obesity) rates have almost stabilized in Italy, England and the US and they have grown modestly in Canada, Korea and Spain.<sup>43</sup> Looking at obesity levels, the US still stands out with 31.6% of men and 33.9% of women obese, accounting for 13% of obese people worldwide. Other rich countries with high obesity rates are the UK, Australia and Germany.

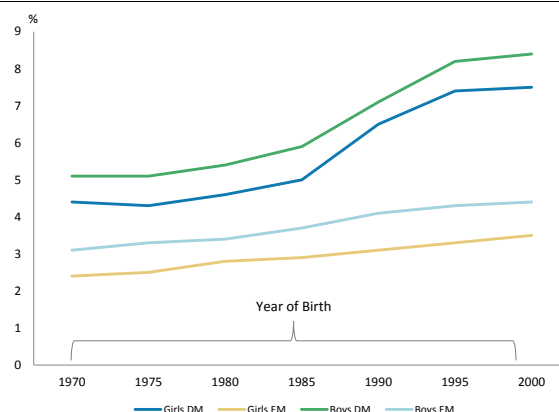
**What is new is that overweight and obese people are now preponderant in developing countries, rather than the developed world.** Since 1980, the number overweight and obese has more than trebled from 250 million (with overweight and obesity more prevalent among the women). Although age-standardised rates are still lower than in the developed world, 62% of the world's obese individuals now live in developing countries (primarily China, India, Russia, Brazil, Mexico, Egypt, Pakistan, Indonesia, listed in order of number of obese individuals).

When looking at obesity rates alone (i.e. excluding overweight), rates exceeded 50% for men in Tonga and for women in Kuwait, Kiribati, Micronesia, Libya, Qatar, Tonga and Samoa. In China and India, obesity rates are still comparatively low, perhaps also due to under-reporting issues (3.8% for men and 5% for women in China; 3.7% and 4.2%, respectively in India). In sub-Saharan Africa, South Africa recorded the highest adult obesity rates (especially among women 42%).

**Overweight and obesity are increasing in both DM and EM among children and adolescents.** This is an important cause for concern as it boosts the risks of additional complications later in life. In developed countries, the 2013 prevalence of overweight and obese boys and girls was 23.8% and 22.6% respectively (up from 16.9% and 16.2% in 1980). In developing countries, it was 12.9% for boys and 13.4% for girls (up from 8.1% and 8.4%, respectively). Exhibit 48 shows the rise of obesity prevalence (excluding overweight) for adolescents aged 12.5 years.

Exhibit 48

### Prevalence of obesity among adolescents aged 12.5 depending on the year of birth



Source: Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013 (doi:10.1016/S0140-6736(08)61345-8); Morgan Stanley Research

**Even diabetes is no longer a problem of the rich countries...** 80% of diabetics live in low-middle income countries, with double-digit rates of prevalence in several African and Middle East countries, and strikingly high rates (above 25%) in several Pacific Islands (Exhibit 49). Western Pacific is also the region in the world with the highest number of diabetics (138 million).

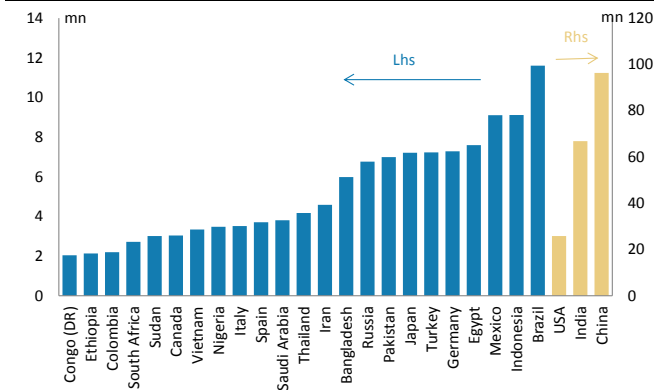
<sup>42</sup> Of the WHO 178 countries reporting countries, the number of those which conduct surveys of NCD risk factors has already jumped from 30% in 2011 to 63% in 2013.

<sup>43</sup> OECD, Obesity Update, June 2014.

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Exhibit 49

### List of countries where 80% of diabetics live, 2014



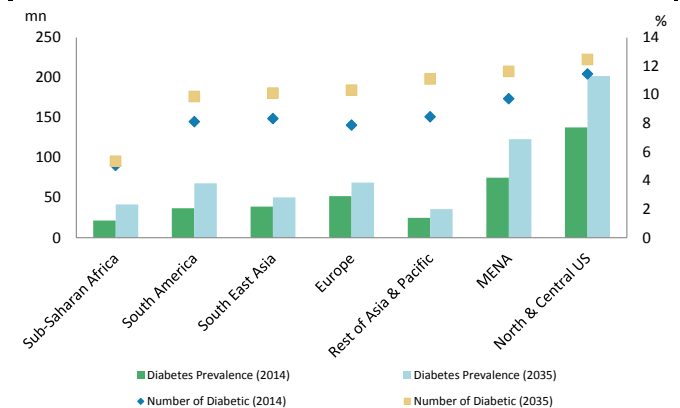
Source: IDF, Morgan Stanley Research

... nor of adults and elderly people. The most common type of diabetes, Type 2, typically affects adults, especially in the 40-59 age bracket. Recently, another form of diabetes has emerged, Type 3, which refers to one form of Alzheimer's disease resulting from resistance to insulin in the brain.<sup>44</sup> However, Type 1, which usually occurs in children or young adults is increasing rapidly, with Europe the region with the highest prevalence (26% of the estimated half a million children under the age of 15 living with Type 1 diabetes worldwide are in Europe, followed by North America and the Caribbean region with 22%). There is also an increasing proportion of children and adolescent with Type 2 diabetes.

The IDF projects that by 2035, the global number of people diagnosed with diabetes will have risen to 600 million (1.5 times current levels) and the world's diabetes prevalence will have reached 10.1% (Exhibit 50). Recent long-term projections for obesity are available only for selected countries. For example, in the US, projections for 2030 range between 42% and 51% of the population (depending on whether using non-linear or linear models), from 33.8% in 2007-2008. As part of our model simulations, we have calculated that even if the world's obesity rate were to steady at current levels, there would be around 450 million more people overweight and obese by 2035; if the recent trend in growth were to continue (extending the moderation of the last few years), the number of overweight and obese people would still rise by nearly 600 million.

Exhibit 50

### Number of diabetic (bars, lhs) and diabetes prevalence (dots, rhs) by region, 2014 and 2035F



F = IDF Forecasts MENA = Middle East and North Africa  
Source: IDF, Morgan Stanley Research

<sup>44</sup> [www.diabetes.co.uk/type3-diabetes](http://www.diabetes.co.uk/type3-diabetes)

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## Mapping Sweet and Sour

**Sugar contribution, directly or indirectly, to the diabetic and obesity epidemic can likely be mitigated only via a combination of collective policy-driven and individual behavioral changes.**

In the Sweet-Sour quadrant, we have identified four scenarios that could materialize depending on the interplay between the following two key variables (Exhibit 51):

- **Will governments intervene to curb sugar consumption and how?**
- **Will the private sector respond to the demonization of sugar and how?**

The slow pace at which governments are acting on diets contrasts sharply with the concerted, and eventually effective, action undertaken to curb smoking and alcohol consumption, especially in OECD countries. In these two areas, significant progress has been achieved through a combination of severe restrictions on advertising, control of sales, information campaigns and, in the case of tobacco, very heavy taxes and controls on smoking in public places.

Instead, we have seen little evidence of political appetite to step up action to curb sugar consumption materially. Resistance from the sugar industry lobby is strong, as attested by the recent opposition to the new FDA labelling proposals to improve information about the 'added sugar' content of products (see page 35).

Moreover, especially in industrialised countries, food choice is considered a sphere of personal freedom, and public interference is not welcome. Our AlphaWise survey (see page 38) shows that the 'sugar tax' is unpopular; in contrast, the majority of respondents in the countries surveyed believes that governments should take actions via financing education campaigns and improving labelling regulations.

Much of the current debate revolves around the appropriateness of government intervention. Possible intervention could include a 'sugar tax', tax incentives for 'healthy' foods or increased regulation – on portion sizes, age or media advertising restrictions, for example.

The focus on the effectiveness of a 'nanny state' is obfuscating the progress that the private sector has begun to make on product innovation. In particular, the food and beverage sector has already started to respond with new

marketing strategies and some product innovations. Companies are partly reacting to shifting consumer demand, but are also trying to protect their public image or to pre-empt prospective government intervention, by offering reduced-sugar options or experimenting new food additives that could substitute sugar at the expense of calories. And there is evidence of progress also in molecular biology and on the medical front.

Furthermore, action can also occur via private/public partnerships. "Social marketing" campaigns are a good example of this. These are campaigns aimed at changing or maintaining people's behavior for the benefit of society as a whole, thus focusing on prevention.<sup>45</sup>

Ultimately, sustainable progress on this front will require a change in individuals' behavior: this can only be achieved by a reduction and a better understanding of the calorie imbalance (not just on the intake but also on the expenditure side).

To this end, both education campaigns and the contribution of the private sector are key, we think. Below, we discuss some of the public and private sector's initiatives that have been implemented so far.

### Public Policies

**With the exception of a few countries, government response to influence diets has been muted so far.**

Governments have a variety of tools through which they can influence diet patterns. These can either encourage the consumption of 'healthy' food or discourage the consumption of food that can, if consumed excessively, lead to illness. These can be grouped into three broad categories<sup>46</sup>:

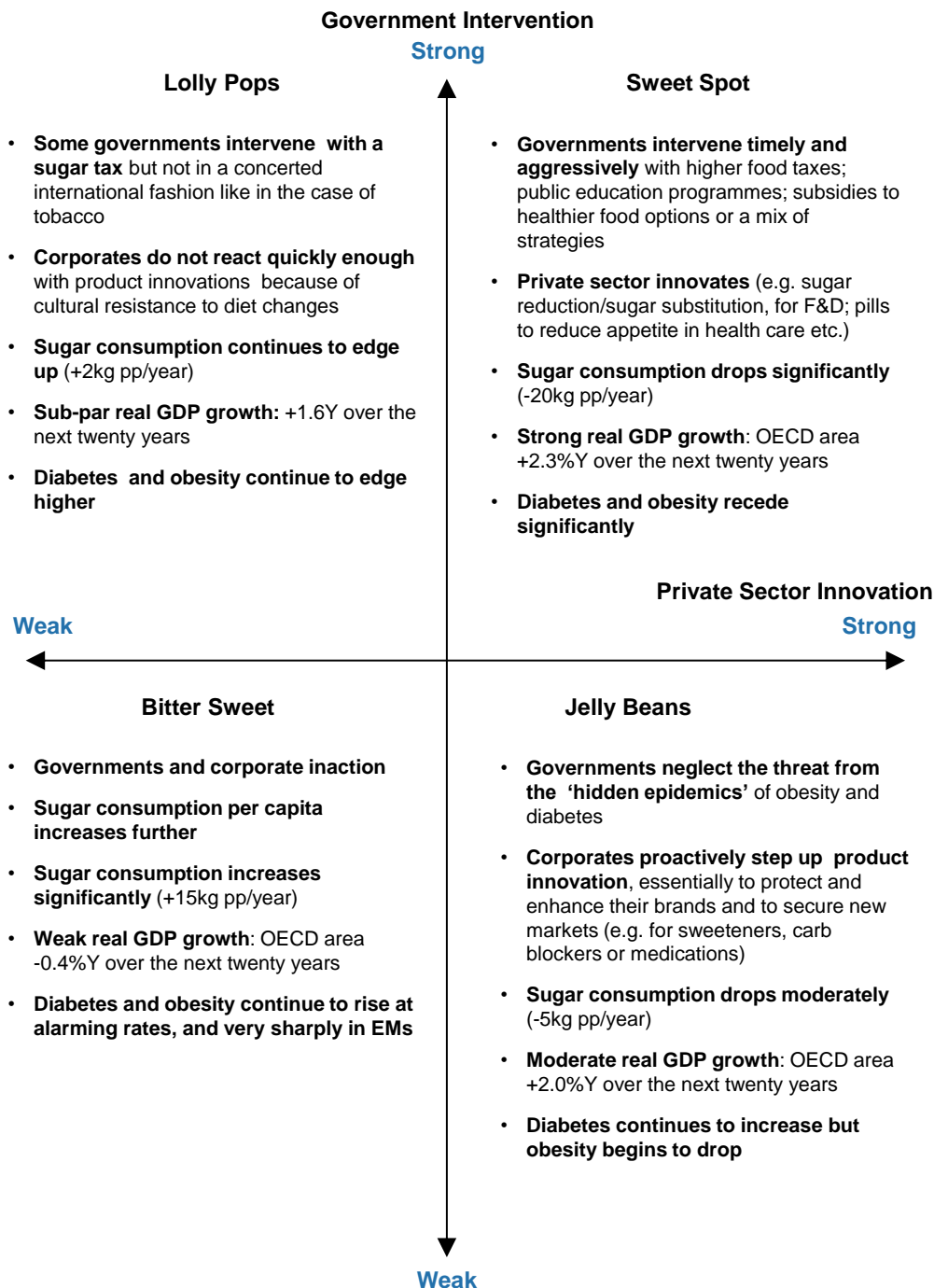
- **Price taxes or price incentives** to increase/decrease the cost of specific food and make it less/more affordable
- **Education campaigns** designed to affect individual choice of food (possibly in partnership with the private sector)
- **Regulation** with restrictions on food processing, labelling, advertising and retailing

<sup>45</sup> An especially large example of social marketing campaign is the UK campaign Change4Life. Established in 2008 and still ongoing, it aims at creating awareness around obesity working with entities in the public and private sector (e.g. large supermarket chains, food companies, convenience stores) (see NHS-UK, 2012).

<sup>46</sup> Governments can also affect diets indirectly, for example via agricultural development policies or by subsidising capital spending to improve logistics and lower unit costs for food distribution. These policies go beyond the remit of this report and will therefore not be addressed.

Exhibit 51

## How will public/private policy action interplay?



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## Price Taxes/Price Incentives

**The most controversial of all possible government intervention measures is the 'sugar tax'.** Proponents of maintain that they are an effective deterrent, especially for children, from consuming too much sugar, particularly if accompanied by incentives for healthier foods (fruit and vegetables). Opponents paint the tax as an ineffective way to tackle the problem of excessive energy intakes, and see them as an unfair burden to low-income individuals. So far, the targets have been largely soda drinks, for which econometric evidence suggests that a 1% increase in price should decrease consumption by about 1%.<sup>47</sup>

**A number of countries have already introduced a 'sugar tax' or considered it.** For example, in Europe, Norway has an excise duty on refined sugar products, including soft drinks, and taxes exist in Denmark, France, Finland, Hungary and Latvia on sugary foods and sugar-sweetened beverages. In May 2014, Lithuania banned sales of energy drinks to minors. In the US, currently 4 states only have a tax on soft drinks and voters in Berkeley (California) passed a 1 cent per ounce tax on sugar-sweetened beverages in November 2014.

Among emerging markets, the most notable case, and perhaps the most closely followed, to assess its effectiveness on rampant obesity rates, is the soda tax in Mexico, along with a 5% tax on junk-food. Following its introduction at the end of 2013, a study by the National Institute of Public Health noted a 10% decline in consumption during the first three months of 2014 on a year-on-year basis; however so far elasticity has been lower than expected.<sup>48</sup> And, in India, Prime Minister Modi introduced a 5% excise duty on sugary carbonated drinks in its first budget in July 2014.

## Education Campaigns

**Food-Based Dietary Guidelines (FBDGs).** The most common information communication tools are national FBDGs, which recommend the balance of food/nutrients that the population should be consuming for a healthy diet. The guidelines may differ across populations, depending on diverse nutritional needs and different lifestyles. They are often presented in an understandable, consumer-friendly format (Exhibit ). They form the base of the Guideline Daily

Amount (GDA) for an average adult caloric intake, which features on packaging of many food items.

**There is evidence that some countries are increasingly orienting their FBDGs towards obesity prevention.** For example, the seventh edition of the US dietary guidelines (2010) was based on the principles to achieve and sustain a healthy weight. Where evaluation evidence exists, it suggests that although consumers are aware of FBDGs, they do not understand them or translate them into practice.<sup>49</sup>

Exhibit 52

### Examples of FBDG posters and slogans



Source: National government sources, Morgan Stanley Research

**Generic healthy eating campaigns.** Broadly speaking these involve the development and communication of messages that aim to make the public aware of the importance of healthy eating in general. For example, they can encourage people to 'eat more' (e.g. fruit and vegetables) or 'eat less' (e.g. salt, fat) of certain types of food/nutrient, through promoting awareness of the benefit/damages of consumption. They usually leverage on catchy slogans. A very popular one is '5 a day' or '6 a day', which has been adopted by numerous countries to promote increased consumption of fruit and vegetables.

Together with salt, anti-sugar campaigns are among the few examples of public awareness campaigns designed to discourage the consumption of a specific product or nutrient around the world. Two examples stand out: the anti-sugar campaign in Thailand; and the campaign against sugar-sweetened beverages in New York City, some other parts of the US and Mexico (see Sugar Cube 3 Box).<sup>50</sup>

<sup>47</sup> Blakely T, Wilson N, Kaye-Blake B (2014) Taxes on Sugar-Sweetened Beverages to Curb Future Obesity and Diabetes Epidemics. PLoS Med 11(1): e1001583. doi:10.1371/journal.pmed.1001583.

<sup>48</sup> See Mexican Food Consumers Continue to Defy Global Trends on Health & Wellness, Morgan Stanley Research, November 2014.

<sup>49</sup> Corinna Hawkes, Promoting healthy diets through nutrition education and changes in the food environment: an international review of actions and their effectiveness, FAO, 2013.

<sup>50</sup> Corinna Hawkes, Op. cit.

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## SUGAR CUBE #3:

### ANTI SUGAR CAMPAIGNS

In **Thailand**, a group of dentists, paediatricians and nutritionists (the Thai Health Foundation) formed the "Sweet Enough Network" in 2003, amid concerns about high rates of sugar intake and the increase of obesity, diabetes and dental caries. They launched a public awareness campaign with a logo (Noynoi) used on books, games, and videos in order to entertain and educate children and initiated a movement to eliminate sugar out of 6 months to 3 years old milk formula, which led to the development of a government regulation to prohibit it.

In **New York City** the negative public awareness campaign focused on sugar-sweetened beverages. Launched in 2009, with the slogan "Pouring on the Pounds," the campaign drew attention to the fact that drinking one 20-ounce soda a day translates to eating 50 pounds of sugar a year. The campaign featured TV spots, subway posters, healthy alternatives flyers and a logo saying "NYC Go Sugary drink Free" (New York City Department of Health and Mental Hygiene, 2013). It has been implemented in three waves, and has now been used by other states (Hawaii, for example). The city government also launched a mass media campaign in 2012 to educate citizens about the links between sugary drinks, weight gain and diabetes as part of the Food Fit Philly campaign (Philadelphia Department of Public Health, 2013). Via the TV and radio spots, subway posters and fact sheets, it targets primarily parents and caregivers of overweight/obese young people.

In **Mexico**, a mass media campaign warning consumers about the effects of sugar sweetened beverages started in 2012 in the public transportation system (Alianza por la Salud Alimentaria, 2013). The campaign uses images of the complications of diabetes (e.g. amputations and blindness), querying the contribution of sweetened soft drinks towards the problem.

### Healthy eating campaigns have been adopted widely in Europe and North America.

In the EU, a survey in 2008-2009 by the European Food Information Council (EUFIC) identified 125 healthy eating campaigns being conducted during the time of the survey, and most countries had more than one.<sup>51</sup>

**South Korea is also a good example of how, via education and campaigning, the country has managed to retain healthy elements of its traditional diet** (especially vegetables); in fact, it now records lower obesity rates than other countries with a similar level of GDP.<sup>52</sup> The number of healthy campaigns is also rising in emerging markets: one example of a region known to have conducted several such campaigns is the Pacific Islands, which suffer from relatively high obesity and diabetes rates.

### Evidence of the effectiveness of these campaigns is limited and with mixed results.

In the UK, an independent study commissioned by the UK's Department of Health (DoH) to assess the Change4life campaign found that while the campaign materials achieved increases in awareness among the study participants, it had little impact on attitudes or behaviour. Similarly, although nearly 40 companies have become signatories of the UK Department of Health 'Responsibility Deal Calorie Reduction Pledge' since its launch in 2012, companies' follow up has not always been consistent. However, studies specific to social marketing campaigns – both generic and food-specific – have been subject to systematic review with more encouraging results: out of the 28 studies included in the review, 23 reported a significant positive effect for at least one relevant outcome variable, including fruits and vegetable intake, fat intake, other dietary behaviors, and diet-related health variables.<sup>53</sup>

### Clear labelling can reinforce education and information dissemination.

In the US, the FDA is proposing to update the 20-year old Nutrition Facts label found on most food packages in the United States with new information to reflect changes based on new nutrition science and with key parts of the label such as calories, serving sizes, and percent daily value more prominent. Indeed, the result of a the 2012 Food & Health Survey shows that about 50% of those polled thought it was easier to file their taxes rather than figuring out what should or should not be eaten to be healthier.<sup>54</sup> The FDA proposal would force manufacturers to state the amount of 'added sugar' not just the total sugar amount. However, critics argue that those who pay attention to the labels may already make 'healthier' food choices. Moreover, nutrition terminology may not be fully understood by the general public and argue in favour of a more visual system (like the UK's 'traffic light').

Another recent initiative came into force in November 2014, when the FDA introduced new rules (as part of the 2010 Affordable Care Act), under which restaurant chains with 20 or more outlets must display calories on all menus and menu boards. Other nutritional information - including calories from fat, cholesterol, sugars and protein - must be made available in writing upon request. The new calorie rule covers a broad range of outlets, including cinemas, amusement parks and alcoholic beverages served in restaurants, but not drinks

<sup>51</sup> EUFIC, 2013

<sup>52</sup> Future Diets Op cit.

<sup>53</sup> Corinna Hawkes, Op. cit.

<sup>54</sup> [foodinsight.org/2012\\_Food\\_Health\\_Survey\\_Consumer\\_Attitudes\\_toward\\_Food\\_Safety\\_Nutrition\\_Health](http://foodinsight.org/2012_Food_Health_Survey_Consumer_Attitudes_toward_Food_Safety_Nutrition_Health)



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served at a bar. The UK DoH instead has adopted a softer approach, as it asks the signatories of the Responsibility Deal to make 'a voluntary commitment to display calorie information clearly and prominently' on menus and/or menu boards, for food and non-alcoholic drinks consumed out of the home.

#### **Finally, governments can also intervene with restrictions on sugar processing, retailing and advertising.**

Restrictions on sugar processing are probably the most difficult to implement, as they require clear standards of what sugar content is 'healthy' or 'unhealthy' and pose major implementation challenges as well as costs. Examples on this front exist for products different from sugar: for instance, 12 European countries regulate maximum salt content in specific foods.<sup>55</sup> Denmark – as well as Austria, Iceland and Switzerland – have trans fats bans, which were introduced in 2004. Denmark was among the first countries to introduce the ban and, as a result, it now ranks comparatively very low when measuring the grams of trans fat served in Danish fast-food chains.<sup>56</sup>

**Examples of restrictions on retailing are also limited, albeit increasing.** For example, in the UK, government policy bans the sale of fizzy drinks, crisps and sweets in local authority-run schools, but head teachers can decide whether children can bring them into schools. A similar ban exists in Australian school canteens – although compliance has reportedly not been very strict – and restrictions exist in Mexico.

**Calls for advertising regulation are rising.** Concerns about advertising of high-calorie food, especially aimed at children have heightened so much that in September 2014 the WHO recommended that governments play a key role in reducing children's exposure to food marketing.<sup>57</sup> In 2007, the UK was the first country to introduce statutory restrictions of TV food advertisements to children. Mexico followed in the summer of 2014 and the Netherlands increased the ban from seven years old to 12 years old in January 2015. In Spain and Norway, instead, food and beverage companies have agreed on self-regulation (i.e. the companies introduce restrictions on a voluntary basis) but overseen by governments.

## **Private Sector Policies**

**The food & beverage sector is a good example of how manufacturers are altering tactics.** Partly responding to shifting consumer demand, to protect their public image, or even to pre-empt prospective government intervention, food & beverage producers have begun to react to changing consumer preference with a combination of new marketing strategies and product innovation. Some are engaging in campaigns sponsoring health programs: Kellogg's – the manufacturer of cereals which have recently been under fire for their high-sugar content – is currently running 'Together We Can Change Lives', a global campaign, committed to girls' and women's empowerment by raising funds and awareness in health, as well as justice and education; Coca Cola has issued a 'responsible marketing charter' detailing the steps it has undertaken to assuage consumers' and parents' concerns.

**Others have started to reduce the fructose content of their products or are experimenting with combinations of existing or new sweeteners.** For example, the much-cited Heinz Classic Tomato Ketchup for its 'hidden' sugar content now has 8.5% less sugar than ten years ago; 'no-added sugar' and 'reduced sugar' versions are also available, with the latter using sucralose as a sweetener. However, about 75% of the US\$21bn global sales of reduced-sugar packaged foods are sugar-free chewing gums and sugar-free confectionary; so this market sector is still skewed toward only two categories of products (Exhibit 51). Moreover, educating palates to a less sweet taste will likely neither be easy nor rapid.

**However, artificial sweeteners have a negative 'chemical' image to overcome.** With the prospect of gradually more informed buyers, manufacturers face the additional challenge of overcoming the negative 'artificial' and 'chemical' image of sweeteners (for example the political and medical controversies around Aspartame); some of them also have a bitter aftertaste. The natural connotation of Stevia partly explains its growing popularity, with increasing demand in the US, China and in large EU countries. In any case, the reduced-calorie or sugar-free lines will probably continue to gain traction, if anything to respond to the growing needs of diabetics and obese people.

**Companies are also broadening product choices through resizing.** The mini-portions/ mini-cans are the latest move by food and beverage manufacturers to broaden their product offerings of smaller portion sizes to help consumers limit their

<sup>55</sup> Mapping salt reduction initiatives in the WHO European Region, WHO, 2013.

<sup>56</sup> Future Diets, Op.cit.

<sup>57</sup> [WHO – protecting children from the harmful effects of food & drink marketing](#)



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caloric intake. In principle, these should help consumers limit their caloric intake but the risk is that they may boost consumption; furthermore, they are also relatively more expensive. Nevertheless, they mark a sharp inversion to the trend, which had seen the average soda sold in the United States more than double in size since the 1950s, from 6.5 ounces to 16.2 ounces.

**Ultimately, in addition to demand, innovation will be driven by several factors, including competitiveness and advancements in molecular biology technology.** In 2013, a group of scientists discovered an ion (protein) channel that allows taste buds to communicate with the brain. The research is in its early stages, but it could potentially help develop ingredients that would make taste cells more sensitive to sweet things, so the same sensation could be replicated by eating less sugar.<sup>58</sup>

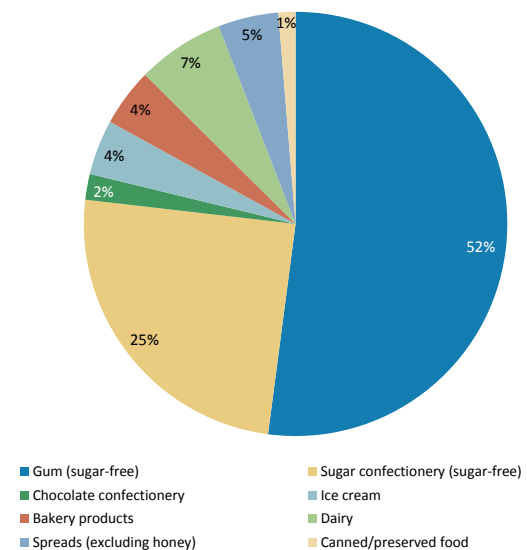
**Progress on product innovation is not just in the food and beverage sector but also on the medical front.**

Recently, two separate studies have shown that it may be possible to alter the way in which we store fat or intervene on the enzyme (glucokinase) that drives the cravings for sugar to the brain hypothalamus.<sup>59</sup> Furthermore, researchers are reportedly working on a new compound which, via connecting three naturally occurring hormones (GPL-1, GIP and glucagon), could lower blood sugar levels and reduce appetite, in practice mirroring the effects of gastric weight loss surgeries.<sup>60</sup>

**So, the potential for groundbreaking innovation is remarkable and should be monitored by investors who want to play the sugar theme more closely.**

Exhibit 51

**Global sales of reduced-sugar packaged food by category, 2014**



Source: Euromonitor, Morgan Stanley Research

<sup>58</sup> [livescience.com/The-Bittersweet-Truth-About-How-Taste-Works](http://livescience.com/The-Bittersweet-Truth-About-How-Taste-Works)

<sup>59</sup> [independent.co.uk/obesity-pill-that-could-replace-the-treadmill](http://independent.co.uk/obesity-pill-that-could-replace-the-treadmill)

<sup>60</sup> [diabetes.co.uk/new-super-drug-found-to-cure-type-2-diabetes](http://diabetes.co.uk/new-super-drug-found-to-cure-type-2-diabetes)

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## Sugar Survey: Analysis of Results

We conducted a proprietary survey of a nationally-representative sample of 1,000 in three countries: Australia, Brazil and Germany. We chose these countries because they all have a comparatively high sugar calorie intake. Interviewing was conducted via online survey in October 2014.

Overall, we would conclude that:

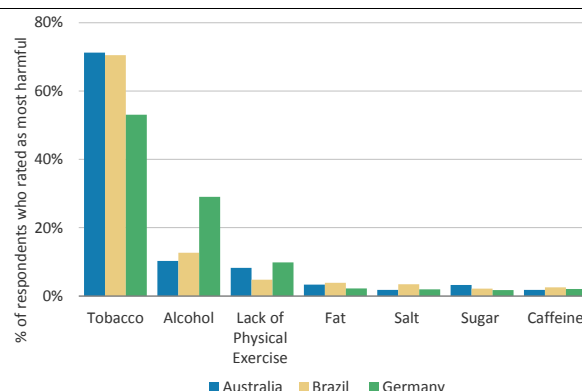
- Consumers do recognize that cutting out sugar may help them to lose weight.** This was the most common response in all three countries when considering the top three changes that respondents believe they would make if they wanted to lose weight.
- However, they are not aware of the sugar content of food.** Our survey asked respondents to choose which of six different foods contained the most sugar. Only 6-8% of respondents correctly identified the food with the highest sugar content.
- Consumers do believe that the health of the population needs to improve.** Less than 2% of respondents said that nothing needs to be done to improve people's health.
- But this should be done by educating consumers rather than introducing calorie-related taxes.** Between 47-58% of respondents believe the most important actions that should be taken by the governments are financing education campaigns and improving labelling. Only 6-12% of responses chose taxes as the most important government action.

**We asked respondents to rank seven factors from most to least harmful to their health: tobacco, alcohol, caffeine, salt, sugar, fat, lack of physical exercise.**

The results of this question suggest that sugar is not viewed as being as harmful to people's health as tobacco or alcohol. In all three countries, only 2%-3% of the respondents ranked sugar as most harmful, which was around the same level of response as caffeine, salt and fat. In contrast, there is wide awareness of the risks of tobacco and alcohol. Around 70% of respondents in Australia and Brazil ranked tobacco as the most harmful. In Germany 53% of respondents chose tobacco and 29% considered alcohol to be the most harmful to health.

Exhibit 52

### Tobacco is seen as being the most harmful factor on health

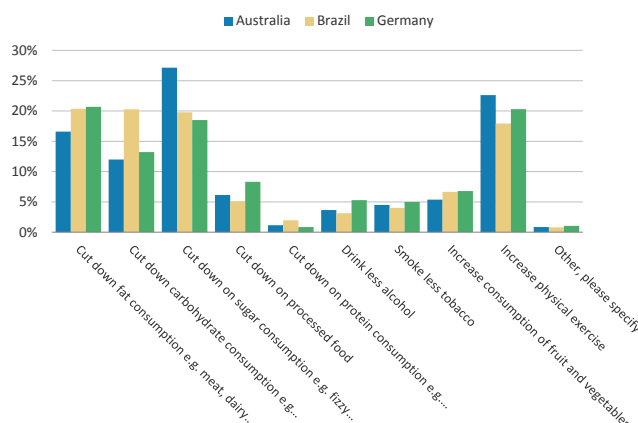


Source: AlphaWise, Morgan Stanley Research

### Respondents were asked if they wanted to lose weight, which changes would they be most likely to make.

Exhibit 53

### "The most likely change" that respondents believe they would make if they wanted to lose weight



Source: AlphaWise, Morgan Stanley Research

When only considering the "most likely" change, "Cutting down on sugar" consumption was the most popular answer in Australia (27%) and joint most popular in Brazil (20%). It was also a very common answer in Germany with 19% of respondents choosing it as the most likely change, just below reducing fat (21%) and increasing physical exercise (20%).

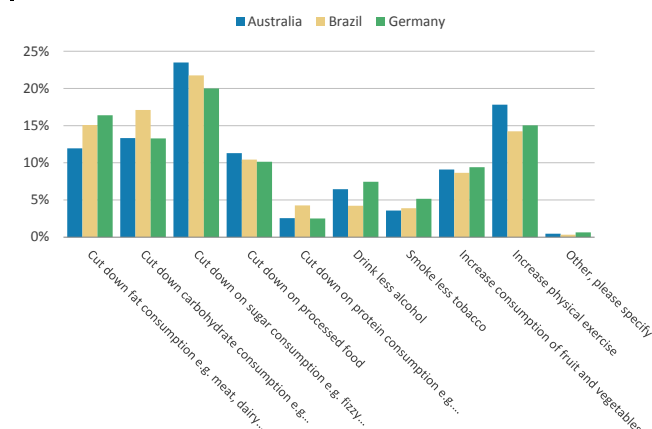
When all three top answers were combined then "Cutting down on sugar" becomes the most common response in all three countries at 23% of all responses in Australia, 22% in

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Brazil and 20% in Germany. As the exhibit below shows, this is 4 or 5 percentage points higher than the second most common answer.

Exhibit 54

**“The top 3 most likely changes” respondents believe they would make if they wanted to lose weight**

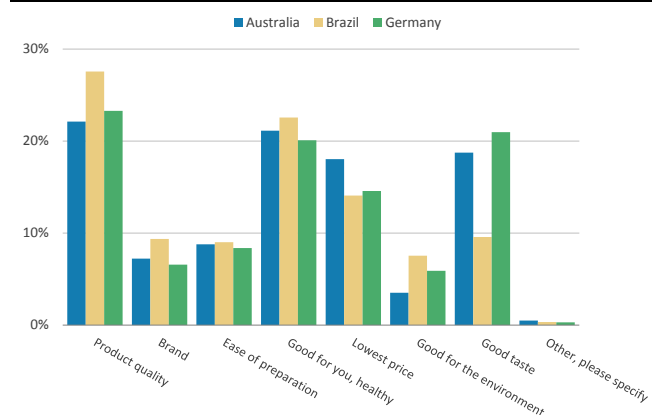


Source: AlphaWise, Morgan Stanley Research

**As part of the survey, respondents had to list the three most important factors they consider when buying food and groceries.**

Exhibit 55

**“Good for you, healthy” food is an important factor for respondents when shopping for groceries.**



Source: AlphaWise, Morgan Stanley Research

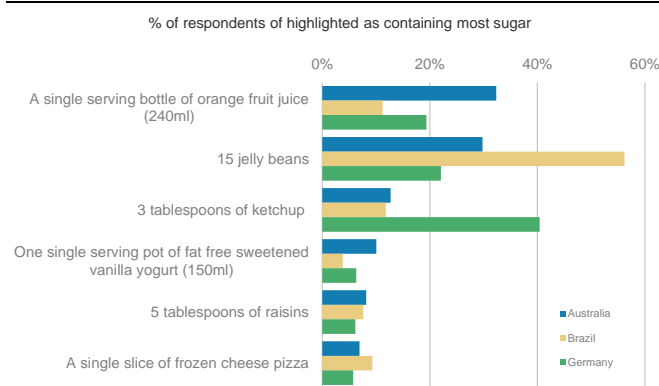
“Product Quality” was the most common answer representing 22%-28% of respondents’ top three factors that are important when shopping for food and groceries. However, interestingly, “Good for you, healthy” was the second most popular response accounting for 21% of the top three factors in Australia, 23% in Brazil and 20% in Germany. Overall, this

may suggest that concerns about health when shopping for groceries does play a role in consumers’ choices, more than brand, ease of preparation and impact on the environment.

**Respondents were asked to rank six commonly eaten foods by their sugar content.**

Exhibit 56

**Respondents do not have a good understanding of which foods contain high amounts of sugar**



Note: on average, the amount of sugar contained in 5 tablespoons of raisins is 35g; in a 150ml serving pot of fat free sweetened vanilla yogurt is 22.3; in a 240ml orange juice is 21.1g; in 15 jelly beans is 15g; in 3 tablespoons of ketchup is 12g and in a single slice of frozen cheese pizza is 7g.

Source: AlphaWise, Morgan Stanley Research

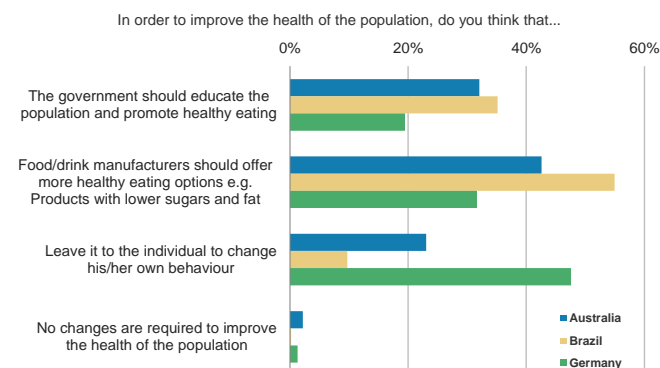
Consumers do not appear to have a good understanding of which foods are high in sugar. Of the six foods listed here, 5 tablespoons of raisins (30g of sugar) contain the most sugar but this was only correctly identified by between 6-8% of people. A large portion of people also failed to identify the relatively large amount of sugar contained in a single pot of fat free sweetened vanilla yogurt (22g of sugar). Only between 4-10% of respondents identified this as containing the most sugar.

**Respondents identified who they thought should be responsible for improving the health of the population – government, food manufacturers or individuals.**

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Exhibit 57

### Respondents are clear that something needs to be changed to improve the health of the population



Source: AlphaWise, Morgan Stanley Research

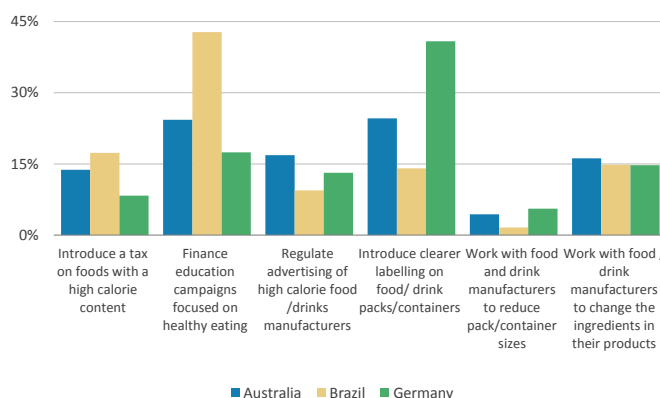
There is a strong consensus in Australia, Brazil and Germany that changes *are* required to improve the health of the population. However, there is a geographic difference in what action people think ought to be taken. In Australia and Brazil the majority of respondents believe the responsibility lies with food and drink manufacturers and the government. In both countries the most popular answer was “*manufacturers should offer more healthy eating options*” and the second most popular answer was “*The government should educate the population and promote healthy eating*”.

Responses from Germany provide a slightly different picture. Here the most popular response was that individuals should be free to change their own behaviour, followed by food or drink manufacturers offering more healthy options. As such, it appears that German respondents believe consumers should be left to make their own decisions about eating habits.

**We asked respondents to rank the three most important actions that they believe governments could take to encourage healthy eating.**

Exhibit 58

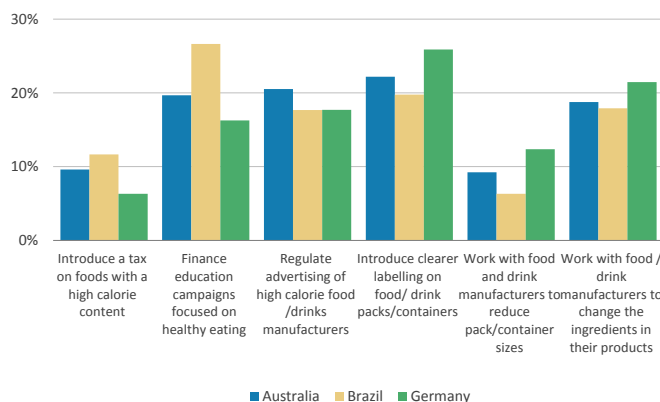
### Most respondents believed consumers should have more information through education and labelling



Source: AlphaWise, Morgan Stanley Research

Exhibit 59

### When considering the top 3 actions, tax on high-calorie foods remained an unpopular choice



Source: AlphaWise, Morgan Stanley Research

Consumers appear to believe that education is the most important way in which governments should encourage healthy eating. Financing education campaigns and introducing clearer labelling on food packaging together represented 47% of the most important responses in Australia, 57% in Brazil and 58% in Germany. Interestingly, “Labelling” was the most popular response in Germany whilst “Education” was a more common answer amongst Australian respondents.

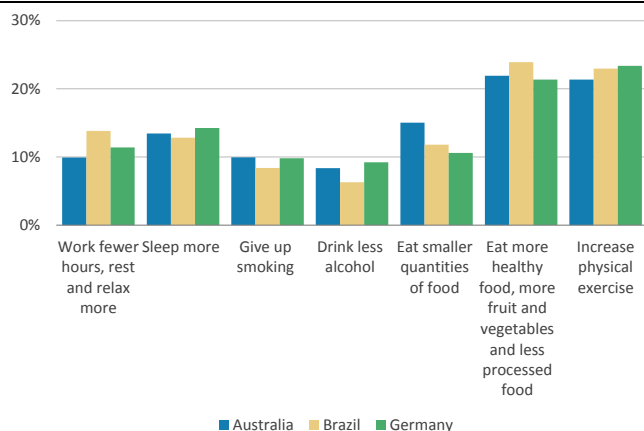
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In contrast, there appears to be very little support for taxing high calorie foods. When considering the top three actions, introducing a tax on high calorie content food only represented 10% of responses in Australia, 12% in Brazil and 6% in Germany.

**Finally, respondents selected the changes they planned to make to their lifestyles in order to improve their health over the next five years.**

Exhibit 60

## Eating more healthily and increasing physical exercise are the two most common planned changes



Source: AlphaWise, Morgan Stanley Research

Eating more healthily and increasing physical exercise were the two most common responses in Australia, Brazil and Germany. In contrast, less than 10% of responses chose “drink less alcohol” or “give up smoking”.

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## Sugar Production

Bennett Meier  
Lee K Jackson

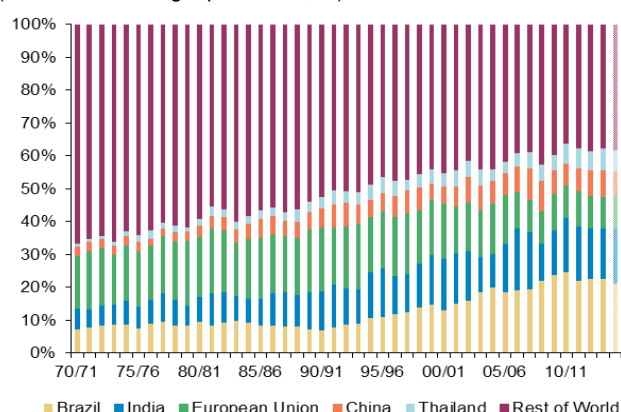
### Production growth remains dominated by EM

The global sugar market is dominated by relatively few, large players. Brazil holds a dominant position, accounting for more than 20% of global production and producing nearly 50% more than the next largest producer, India. Over the past decade, these and other EM producers have accounted for over 100% of net global production growth. While acreage expansion in these regions has helped grow supply, modernization of production practices, including large-scale harvest mechanization, has also boosted productivity. In the face of greater EM competitiveness, sugar production has stagnated in the US and declined in the EU and Australia over the past 10 years. Global exports are even more consolidated than production, with Brazil and Thailand supplying about 60% of world exports. Unsurprisingly, countries with the largest sugar production per capita tend to be the largest net exporters. Major net importers include Indonesia, the United Arab Emirates, the United States, Russia, and occasionally India when domestic output disappoints.

Exhibit 61

### Brazil has been the top contributor to global sugar production growth since 1990

(Share of world sugar production, %)



Source: USDA, Morgan Stanley Commodity Research estimates

### Consumption, production, and price scenarios

**Seemingly small changes in per capita sugar consumption will have wide-ranging implications for sugar production and prices.** In our High Sugar Scenario, which envisions annual per capita consumption growing 5 kg

from 2014 to 2035, global annual sugar production will need to rise more than 51 million metric tonnes (mn MT), representing a CAGR of about 1.23%. However, this would still be below the 20-year historical CAGR of 2.0%. In our Base Case Sugar simulation, which assumes no change in per capita consumption, we estimate that production will need to rise by roughly 11 mn MT, implying a CAGR of approximately 0.28%. In our Low Sugar Scenario, which assumes annual per capita consumption falls 10 kg, production will need to fall about 65 mn MT, a CAGR of approximately -2.19%.

**The magnitude of required production growth is critical to the sugar price implications.** Widespread industrialization of cane production, particularly in Brazil, has allowed yield improvements to contribute the majority of production growth over the past 30 years; however, excess consumption growth has also required global acreage to expand. This expansion often comes at a high price, as conditioning new land for sugarcane plantation is an input and labor-intensive process. Our price assessment in each scenario rests largely on the call that consumption places on global acreage expansion, in light of expected yield growth.

**Yields should continue to trend higher, though the trajectory will be price dependent.** Traditionally the price cycles in sugar have induced periods of yield swings to manage supply, as the 6-year planting cycle for cane prohibits rapid changes in area. These swings have become more pronounced as Brazil has added ethanol production as another avenue for sugar cane. However, taken over a 20-year period, a linear trend increase in yields still provides the best fit. In our High and Base Case Sugar Scenarios, we see prices remaining high enough to maintain the prior 20-year trend growth rate of 1.08% per annum. Our Low Sugar simulation assumes that low prices continue to discourage additional investment in industrialization and plantation renovation, leading to a continuation of the slower, 10-year trend growth rate of just 0.03% p.a.

**With yields likely to grow, acreage will have to adjust in the long term to keep production and consumption in equilibrium.** Based on our yield growth scenarios cited above, we estimate that global acreage will need to rise by roughly 0.9 million hectares (mn Ha), a CAGR of 0.15%, in



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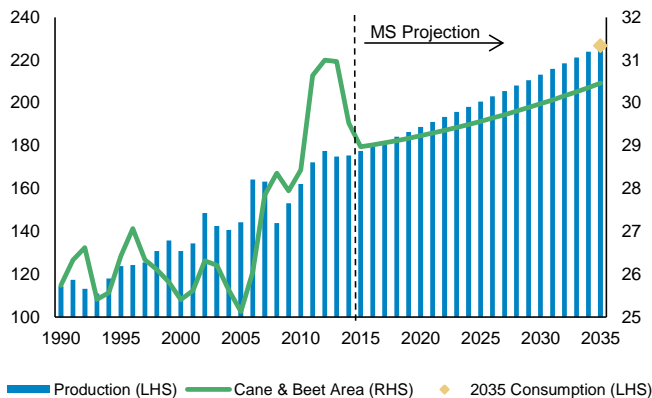
our High Sugar Scenario, fall by 4.5 mn Ha, a CAGR of -0.79%, in our Base Case Scenario, and fall by 11.1 mn Ha, a CAGR of -2.21%, in our Low Scenario.

**In the High Sugar Scenario, Brazil, Thailand, and India are likely to be responsible for most of the growth in global production over the next 21 years.** In our view, the regions with the most opportunity for growth in the next two decades continue to be those that have seen some of the largest growth in production in the prior two. Access to ample land, favorable regulatory regimes and established infrastructure should allow Brazil, India and Thailand to continue to grow their acreage and production capacity to keep up with rising global consumption. Among these, Brazil, already the largest producer and the most responsive to price signals, is likely to see the largest production increases. While trend global sugar yield growth should be sufficient to maintain the necessary 1.23% global production CAGR without taking acreage above the 2012 highs, sugar prices will need to remain high enough to encourage crush capacity expansion. According to our industry contacts in Brazil, raw sugar needs to trade at a minimum of 20 c/lb in the long run for new mill construction to occur. However, we note that this threshold remains extremely levered to regime changes in production costs and BRL levels.

Exhibit 62

### High case sugar simulation: both production and acreage rise

(LHS: world sugar production and consumption, mn MT; RHS: world cane and beet area, mn HA)



Source: FAO, USDA, Diabetes Atlas, WHO, Morgan Stanley Research estimates

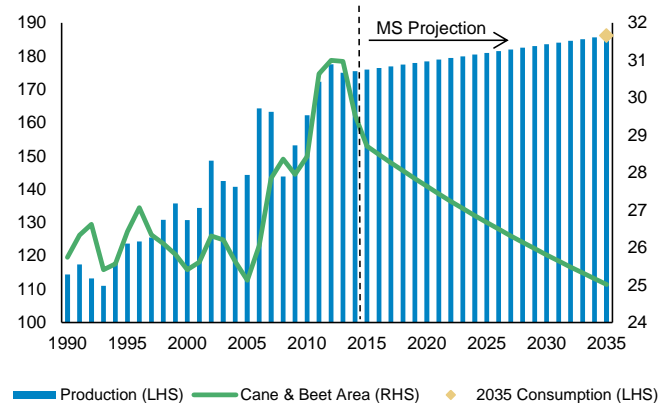
**In the scenarios where global production declines, producer returns for sugar would need to be low relative to those for other crops.** In our Base Case Sugar simulation, most of our forecast 4.5 mn Ha decline could be achieved if soybean returns were attractive enough to incentivize moderate

switching of Brazilian acreage out of sugarcane. Using Sao Paulo production economics as a guide, we see this switching dynamic capping sugar prices no higher than 17 c/lb, assuming long-run soybean returns of 5-15%. Again, the required sugar prices would vary with cost inflation and BRL movement.

Exhibit 63

### Base case sugar simulation: production growth driven by yields

(LHS: world sugar production and consumption, mn MT; RHS: world cane and beet area, mn HA)



Source: FAO, USDA, Diabetes Atlas, WHO, Morgan Stanley Research estimates

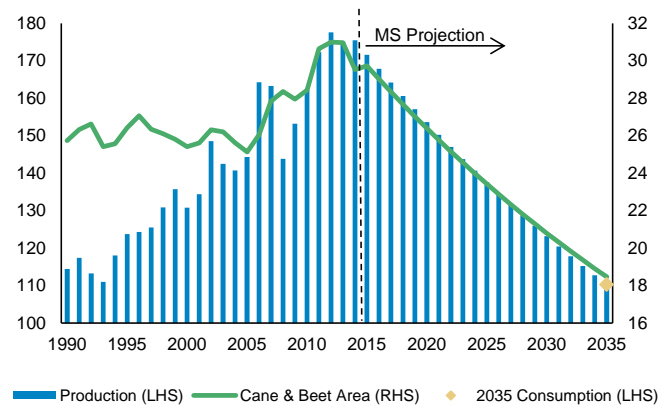
**The 11.1 mn Ha global area drop in our Low Sugar scenario is extreme, and would require eliminating the equivalent of more than the entire sugarcane acreage of Brazil and Thailand.** The magnitude of this decline makes it difficult to pinpoint an exact price that would cause this level of capacity destruction. However, a reduction in acreage most likely would require other crops to remain sustainably more attractive, encouraging farmers to put that land to more productive use. The price ratio of soybeans/sugar of 80 in 2013, the last period in which global sugar acreage fell, would put raw sugar at 12.50 c/lb in a \$10.00/bushel soybean environment. This would likely provide the long-term average ceiling for sugar prices, subject to changes in costs and foreign exchange.

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Exhibit 64

**Low case sugar simulation: production shrinks and acreage falls sharply**

(LHS: world sugar production and consumption, mn MT; RHS: world cane and beet area, mn HA)



Source: FAO, USDA, Diabetes Atlas, WHO, Morgan Stanley Research estimates

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## Brazil Sugar Producers

Javier Martinez de Olcoz  
Rodrigo Mugaburu

### Brazil: A key player in world sugar dynamics

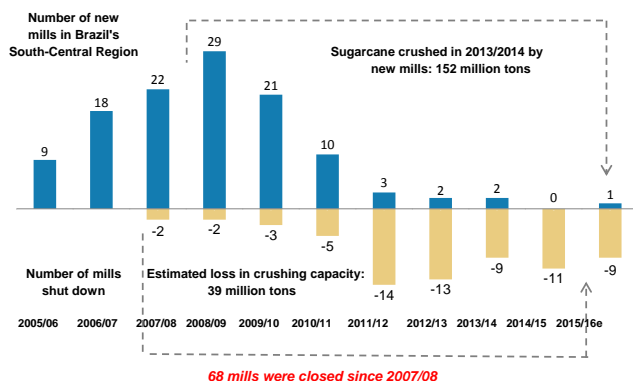
**Brazil sugar production overview:** Brazil is the world's leading producer and the largest exporter (~50% of global sugar trade). Unlike other producing countries, Brazilian farmers can use sugarcane to produce either sugar or ethanol depending on the relative profitability of the products. In addition, the more modern mills can also produce electricity through cogeneration, adding another source of revenue.

**Sugar cycle changed in the last two years...** During past sugar cycles, India was the country that defined the turning point of the cycle and Brazil the one that set prices as it was the marginal producer. However, in the last three seasons as a result of a huge global surplus driven by large production in the northern hemisphere, this dynamic changed, leaving prices below average cost of production in Brazil. As we move towards a global deficit, we now expect Brazil's cost of production to define again the new price levels.

**...negatively impacting Brazil S&E sector.** For Latam producers sugar is a business of scale (cane crushing volumes). As such, running with idle capacity materially increases fixed costs. However, during the last three seasons, the industry has been running with idle capacity as it struggled with low agriculture yields driven by weather disruptions and underinvestment in cane fields due to low sugar and ethanol prices. This situation left the average sugar producer in financial distress, with 68 mills shutting down since 2007/08 or ~18% of total mills in Brazil.

Exhibit 65

### Sugar mills shutting down in Brazil



Source: Company Data, Morgan Stanley Research estimates (e)

Exhibit 66

### Sugar cost of production in Brazil center/south

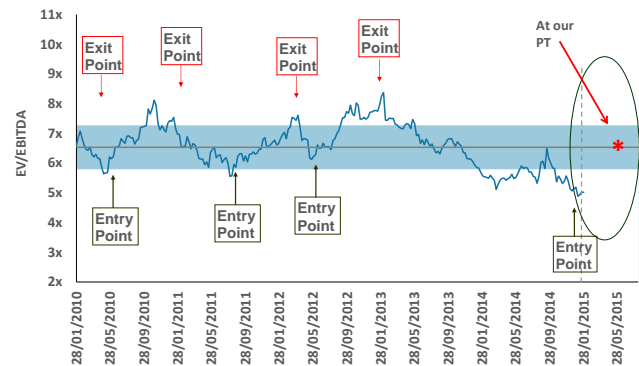
	Usual market unit	Value in market unit	Sugar Value in US\$/lb
<b>Agricultural costs</b>			<b>-3.76</b>
Harvest	R\$/tsc	27.4	-1.89
Cultivation crop area	R\$/ha	1,300	-0.94
Cultivation planting area	R\$/ha		
Investment in planting	R\$/ha	6,500	-0.94
Industrial and G&A			<b>-2.24</b>
Industrial cost	R\$/tsc	10.0	-1.21
G&A	R\$/tsc	8.5	-1.03
Logistic			<b>-2.27</b>
Freight cost	US\$/ton	40.0	-1.82
Elevation cost	US\$/ton	10.0	-0.45
<b>Total cost ex-lease</b>			<b>-8.28</b>
Lease cost	Ton/ha	20.0	-1.45
Suppliers cost	R\$/ton	33.37	-4.05
<b>Total costs with leases and suppliers</b>			<b>-13.78</b>
Capital charges (Capex/WC)			-2.64
<b>Total costs</b>			<b>-16.41</b>
Margin	15%		-2.5
<b>Total With @15% Margin</b>			<b>18.9</b>
<b>Revenues</b>			<b>15.0</b>
<b>Margin US\$/lb</b>			<b>-1.41</b>
<b>%</b>			<b>-9.4%</b>

Source: Company Data, Morgan Stanley Research

**How to play the sector:** In cyclical industries, we tend to analyze multiples through the cycle and identify good entry points at the bottom of the cycle. We see the sugar cycle bottoming in 2H2015 opening a good entry point. Cosan (CSAN3), the world's largest sugar and ethanol producer, is currently trading at historical low multiples.

Exhibit 67

### Cosan SA historical EV/EBITDA



Source: Company Data, Morgan Stanley Research

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## Beverages

Dara Mohsenian

### How is the sector exposed to sugar consumption trends?

The non-alcoholic beverages industry is highly exposed to sugar consumption, as sugar (and/or high-fructose corn syrup) can be found in significant quantities across nearly all full calorie flavored beverage categories. However, within the beverage industry, we believe concerns over sugar consumption will have the most significant impact on full calorie carbonated soft drinks (CSDs). This is because CSDs generally contain more sugar per serving than other food and beverage categories (Exhibit 68) and are devoid of any nutritional or functional benefits.

Exhibit 68

### Sugar content per serving is near highest in CSDs

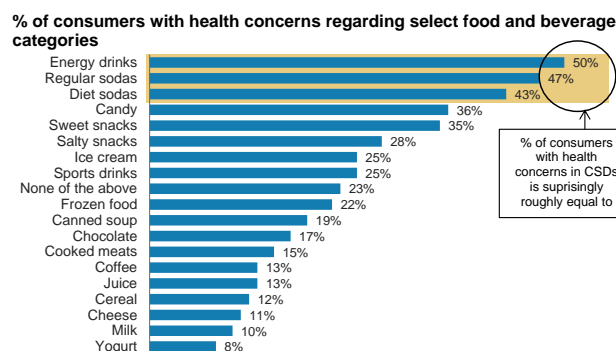
* per Est. Serving	Median Calories*	Median Sugar (g)*
Ice Cream	377	33
<b>Regular Soda</b>	<b>110</b>	<b>29</b>
Fruit Drinks	100	24
Energy Drinks	106	23
Candy	192	21
Cookies	257	21
Orange Juice	112	21
Yogurt	146	19
Apple	95	19
Banana	121	17
Iced Tea/Coffee	66	14
Sports Drinks	50	14
2% Milk	124	12
Orange	62	12
Flavored Water	40	10
Cereal	150	9
Cheese	87	0
Potato Chips	138	0

Beverages content per 8 oz serving. Food content per estimated average serving size.  
Source: SugaryDrinkFacts.org, USDA Database, Morgan Stanley Research

To gauge consumer health/wellness concerns, we conducted an AlphaWise survey of 1,500 US consumers in the fall of 2013, where we found that 47% of consumers have health concerns with full calorie CSDs (Exhibit 69), which is ~2 times greater than the 24% average across food/beverage categories. While beverages such as real fruit juices and milk may also contain significant quantities of sugar, the real or perceived nutritional benefits of those beverages partially offset sugar concerns. In beverages such as energy drinks and sports drinks, functional benefits such as energy or enhanced hydration may offer more permissibility for higher sugar consumption.

Exhibit 69

### CSDs have the most significant health concerns



Source: AlphaWise, Morgan Stanley Research

### Which companies are most exposed (% earnings/ value per share)?

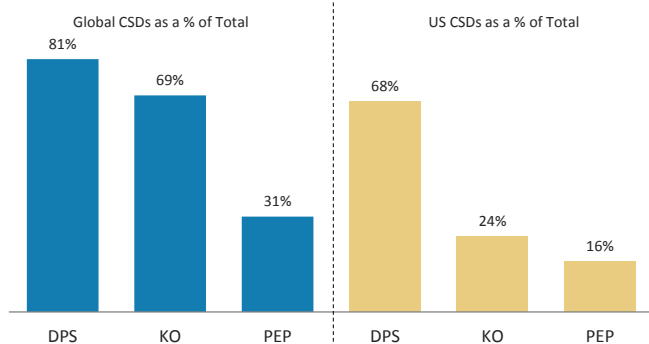
Within the global CSD market, Coca-Cola at 51% share and PepsiCo at 19% share are by far the largest players, with Dr Pepper Snapple Group (DPS) a distant third at 5%. Together, Coca-Cola/PepsiCo/DPS account for ~75% of the global CSD market. As seen in Exhibit 70, DPS and Coca-Cola are both highly exposed to CSD consumption shifts, with CSDs representing 81% of global retail sales at DPS and 69% at Coca-Cola, while PepsiCo faces relatively lower exposure at 31% of mix given its large global snacks business. Relative to its more global peers, DPS is much more exposed to the US (which has seen a more pronounced CSD slowdown than other markets), with 68% of its sales coming from US CSDs, well above 24% and 16% at Coca-Cola and PepsiCo.

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Exhibit 70

## DPS and Coca-Cola are highly exposed to the CSD category, while PepsiCo is relatively less exposed

Company CSD Mix



Source: Euromonitor, Morgan Stanley Research

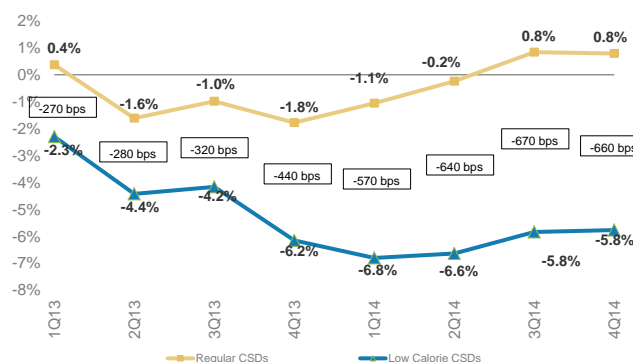
## How is the sector currently responding to the obesity trend?

As a response to concerns over sugar and calories, CSD companies have re-launched and reformulated several varieties of diet and mid-calorie CSDs over the last several years. However, within the US, diet CSD results have recently slowed significantly (Exhibit 71) with negative press over health/wellness due to studies illustrating negative health consequences of diet CSD consumption, as well as studies showing diet CSDs are not as effective in managing weight as previously perceived.

Exhibit 71

## Diet trends have decoupled unfavorably vs regular Colas...

US Tracked Channel CSDs Two-yr Avg. Sales Growth



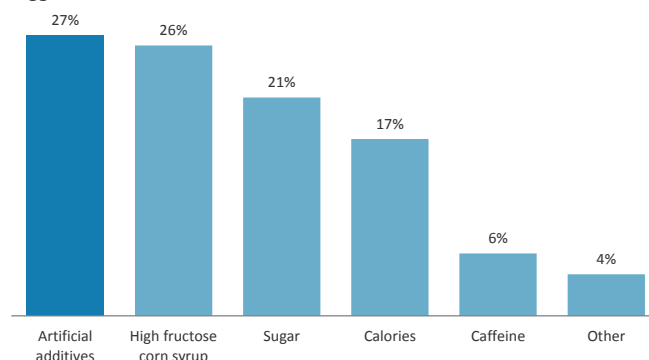
Source: IRI, Morgan Stanley Research

The biggest concern regarding CSDs in our survey was the content of artificial additives in CSDs, which was cited by 27% of respondents as their biggest concern—see Exhibit 72.

Exhibit 72

## ...As consumers are most concerned about artificial additives in CSDs

Biggest concern about soda



Source: AlphaWise, Morgan Stanley Research

There is some possibility that going forward, Coca-Cola and other CSD companies can introduce more effective sweeteners that are natural, superior tasting and have lower calories, in order to gain more traction from consumers with sugar concerns. For example, Coca-Cola introduced Coca-Cola Life, its mid-calorie CSD, in Argentina in June 2013. It has since expanded distribution to Chile, Great Britain, Mexico, and Sweden, as well as a recent November nationwide rollout in the US. Coke Life has ~90 calories per 12 oz. can and is sweetened with Stevia and natural sugar, but contains no artificial sweeteners like aspartame.

We believe that mid-calorie CSDs and sweetener innovation could be modestly favorable in addressing health/wellness concerns, but are unlikely to be a breakthrough product given that in the past mid-calorie CSDs and sweetener innovations have generally failed.

First, we believe CSD consumers prefer either the taste of a fully sweetened CSD or zero calories, and a product that has elements of both will appeal to neither preference. Second, the CSD industry has very a poor record of mid/low-calorie innovation to drive sales growth. Over the past decade, only Coke Zero has been able to capture more than 1 pt of industry share, with failures at a variety of other brands, including Coca-Cola C2, Pepsi Edge, Pepsi One, Pepsi Next, Pepsi Max, and Dr. Pepper 10.

Although it is difficult to completely dismiss sweetener innovation, we continue to believe that the impact to topline would likely be modest, while acknowledging it is a wildcard.

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Exhibit 73

## CSD sweetener innovation

Brand	Calories	Serving Size	Global Mkt Share	USA Mkt Share	Sweeteners Used
Coke Zero	0	355 ml	3.1%	2.8%	aspartame, acesulfame potassium
Coca-Cola C2 70		355 ml	NA	NA	high fructose corn syrup, aspartame, sucralose, acesulfame potassium
Pepsi Edge	50	100 g	NA	NA	high fructose corn syrup, sucralose
Pepsi One	0	355 ml	NA	NA	sucralose, acesulfame potassium
Pepsi Next	60	355 ml	NA	NA	high fructose corn syrup, sugar, sucralose, acesulfame potassium
Pepsi Max	0	355 ml	0.8%	0.2%	aspartame, acesulfame potassium
Dr. Pepper 10 10		355 ml	NA	0.2%	high fructose corn syrup, aspartame, acesulfame potassium

Source: Euromonitor, Company Data, Morgan Stanley Research

## What is our base case for long-term growth in related parts of the sector?

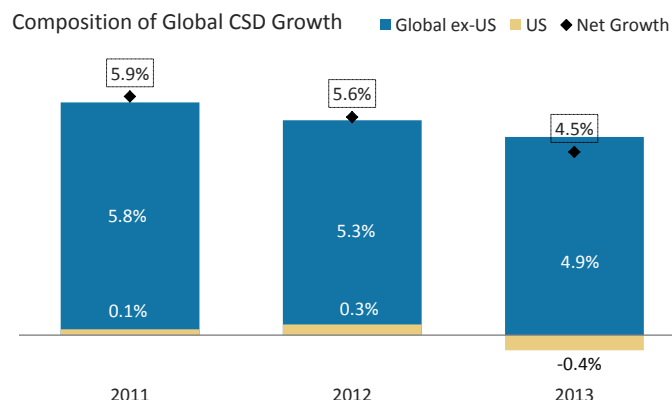
Over the last five years, CSD volume growth has been significantly below other NARTD (non-alcoholic ready to drink) beverage categories at a +1.1% CAGR, well below the +5.4% CAGR of total all other soft drinks. As shown in Exhibit 74, in 2013, CSD sales growth decelerated by -120 bps YoY vs. its average growth rate in 2011/12, while the rest of the staples group sales growth was generally flat or accelerated from a sales growth standpoint, including non-CSD beverages, snacks, food, and household products. While in theory this could be due to greater macro sensitivity, historically in the previous 2008/2009 macro downturn (which was a much more severe downturn) CSDs did not slow much more than other categories. This clearly indicates to us that there are other issues pressuring CSDs beyond macros.

The slowdown has been most pronounced in the US, which drove nearly 60% of the global category slowdown in 2013, but clearly international CSD growth has been slowing as well.

**Over the long term, we believe CSD volume softness will continue.** With total all other NARTD beverages annual volume growth of +5.4% outpacing CSD annual volume growth of +1.1% over the last 5 years, we expect CSD's share of the global NARTD beverages category to continue to decline. We forecast going forward global CSD volume share of the NARTD category will decline by ~80 bps annually close to the 90 bp decline in each of the last two years, as higher marketing from Coke provides a modest lift. To put this into perspective, 80 bps of global NARTD beverages volume represents ~\$5.5bn at current CSD pricing.

Exhibit 74

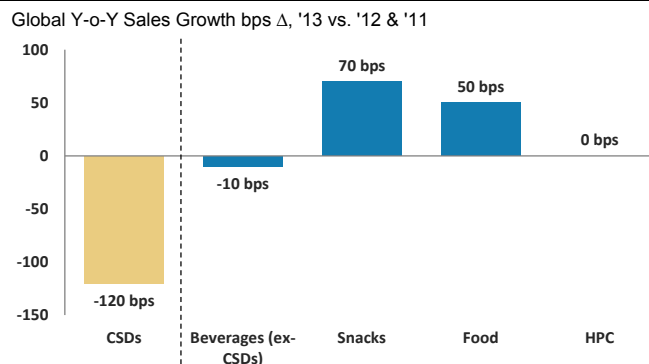
## The deceleration in global CSD growth occurred in both the US and internationally



Source: Euromonitor, Morgan Stanley Research

Exhibit 75

## CSD sales growth dropped in 2013 vs. recent trend more than other CPG categories

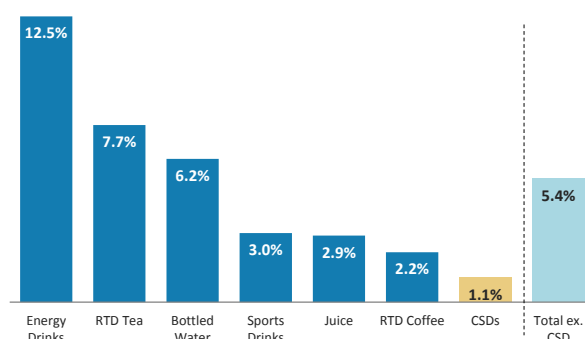


Source: Euromonitor, Morgan Stanley Research

Exhibit 76

## Global CSD 5-yr. volume CAGR is below all other NARTD beverage categories

Global Category Volume CAGR, '08-'13



Source: Euromonitor, Morgan Stanley Research

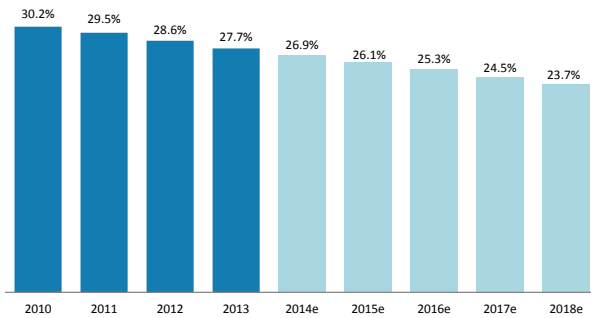


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Exhibit 77

## Global CSD share declines expected to continue

Global CSD Share of Total NARTD Beverages



Source: Euromonitor

## What would the impact be on growth and returns if governments regulated sugar consumption?

As health and wellness pressures continue to mount, it is possible that soda consumption taxes could increase, but we believe this is a manageable risk. In the US, most proposals for taxes or other restrictions on CSDs have failed to pass, including the recent failure of a soda tax proposal in San Francisco as well as the more high profile failure of a proposal to ban large size soft drinks in New York City. The one exception is the first US soda tax passed in November 2014 in Berkeley CA. We believe that most CSD tax proposals have failed to pass as they have been accompanied by very little consumer support. This is consistent with our AlphaWise survey results, which indicate that a majority of US consumers do not support (53%) or are ambivalent (19%) towards taxing sugar-sweetened soft drinks (Exhibit 78).

However, the possibility of future proposals being passed can't be ruled out, particularly as the results of the nationwide calorie tax in Mexico, enacted in January 2014, become more fully available. As such, our base case momentum scenario could see downside from a further consumer driven volume deceleration and/or potential future taxes and other restrictions.

## What would the impact be on growth and returns if sugar consumption does moderate?

A moderation of sugar consumption would have a direct impact on CSD companies. However, they may be able to mitigate the impact of volume pressures through greater price/mix growth.

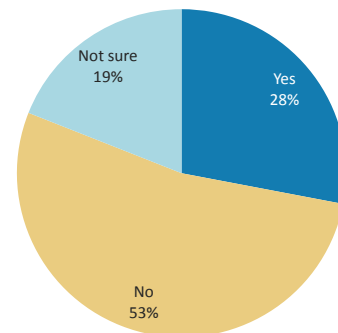
Coke recently announced a more rational stance over pricing, with a focus on driving price increases and positive mix shifts particularly in developed markets such as the US. While CSDs have historically been able to attract more consumers

given prices are below other flavored beverages categories, cheaper prices are becoming less of a consumption driver as more consumers actively seek to avoid CSDs due to health concerns. As a result, the price elasticity of demand for CSDs has decreased in the US over time. In Exhibit 79, we show that the  $R^2$  for regressions of monthly YoY volume growth vs. price growth for Coke CSDs within the US food/grocery channel has declined substantially between 2011 and 2014 to the low 30% range from the low 80% range in 2011. Given the lower consumer price sensitivity and Coke's stance on driving a more rational CSD pricing environment in developed markets (which we have seen playing out to an extent in recent US scanner data trends), improved price/mix could provide some top and bottom line upside to mitigate the base case scenario volume declines with health/wellness.

Exhibit 78

## Most consumers do not support or are ambivalent towards taxing CSDs

Support taxing sugar-sweetened soft drinks (Oct '13)

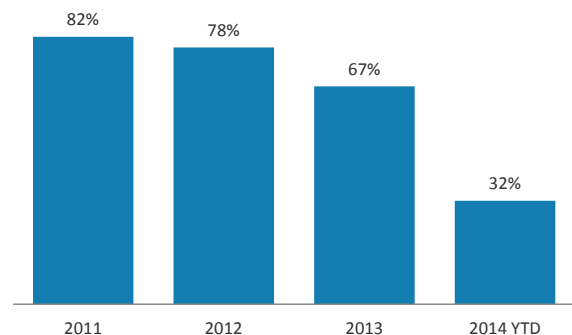


Source: AlphaWise, Morgan Stanley Research

Exhibit 79

## Correlation between US price and volume declining

$R^2$  of KO CSD Monthly YoY % Volume  $\Delta$  vs. YoY % Price  $\Delta$   
(US Food Channel Scanner Data)



Source: IRI, Morgan Stanley Research

For more details please see our AlphaWise Survey: [click here](#) from January 2014.

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## Food Producers

Erik Sjogren  
Matthew Grainger

### How is the sector exposed to sugar consumption trends?

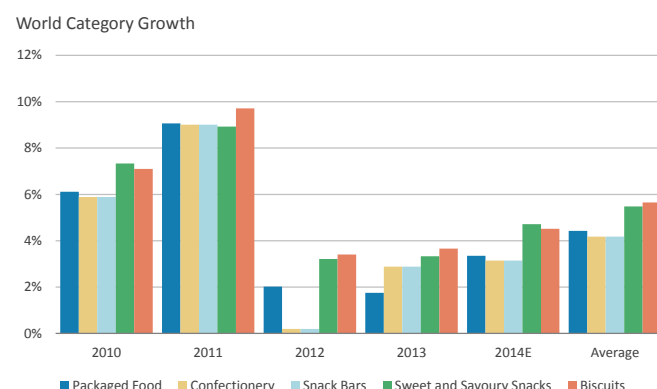
**Within the Food industry, sugar-oriented products have been strong growth contributors in recent years.**

Specifically, Euromonitor data detailing category growth trends during the past five years (2009-14E) suggests that categories such as Biscuits and Sweet Snacks have been advantaged sources of growth, up ~5.5% during the period versus the broader Packaged Food industry up only ~4.4%. In addition, this gap in growth has expanded modestly in recent years as category trends have slowed, with these sweeter product segments sustaining ~4% growth. While the confectionary category has been somewhat more volatile due to weakness in the gum category, this has masked ongoing strength in chocolate. While growth in sugary categories has slowed in absolute terms, we would attribute some of this trend to increasing awareness of the associated health implication. However, this is also a function of lower inflation and related pricing actions across the Food sector, as well as an ongoing moderation in growth (and discretionary purchasing power) in key Emerging Markets such as China and Brazil.

**These categories have seen industry-average trends in Emerging Markets, but have proven valuable sources of growth,** particularly as disposable income increases and provides consumers with the greater capacity for discretionary food purchases. Going forward, we expect sugar-based categories to continue to outpace the broader packaged food sector as global food manufacturers seek to increase new product innovation, optimize consumer affordability and pack sizes, and expand into new geographies. However, as addressed more broadly in this report, we do believe longer-term headwinds could emerge in the form of increased governmental and consumer awareness of the health problems associated with hievels of sugar consumption, with a large number of initiatives already in place across markets to steer consumers towards healthier foods and lower content of sugar amongst other ingredients.

Exhibit 80

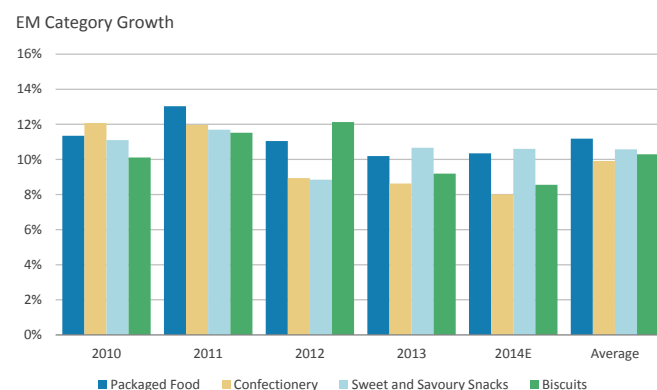
### Global growth of sugary categories



Source: Euromonitor

Exhibit 81

### EM growth of sugary categories



Source: Euromonitor

### Which companies are most exposed (% earnings/ value per share)?

**Within Morgan Stanley's US packaged food universe, Hershey and Mondelez have the highest levels of exposure to the aforementioned "sweet" categories.**

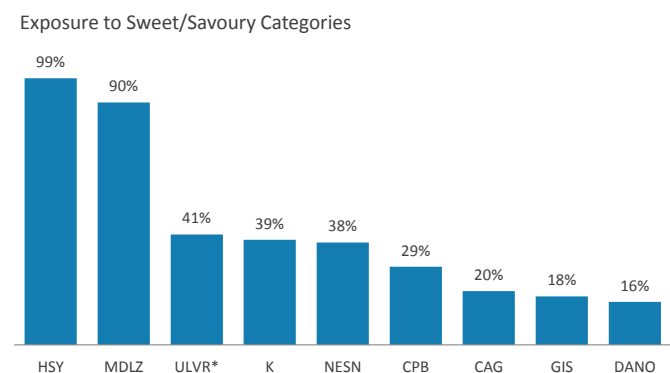
Hershey is essentially 100% exposed to sweet categories due to its confectionary-based portfolio, while Mondelez – taking into account both sweet and savoury snacks – has overall exposure of ~90% (54% confectionary, 31% biscuits, and 5% Sweet Snacks). Kellogg, Campbell Soup and General Mills

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also have notable exposure to sweet categories primarily through sweet snacks, snack bars, and biscuits.

Exhibit 82

### Percentage of sales from sugary categories



\* Unilever Food and Refreshment divisions combined.  
Source: Euromonitor, Company Data, Morgan Stanley Research

**In European Food Nestlé and Unilever's Food business have some 40% of sales from 'sweet' categories,** primarily through confectionery for Nestlé and ice cream for both Nestlé and Unilever. Danone's portfolio is highly geared towards categories with a high health profile, but we have in the below included part of the group's fresh dairy business as sugary, given its exposure to dairy desserts, even if the yogurt category overall has lower sugar content compared to many other food categories.

### How is the sector currently responding to the obesity trend?

**In recognition of health concerns surrounding sugar, manufacturers have begun to adapt their portfolios.** In particular, we would note the following examples across our US and European coverage:

**Portion sizes are getting smaller.** Both Hershey and Mondelez have started to offer more products in portion controlled sizes or with reduced sugar, such as Hershey's Sugar Free and Oreo 100 calorie packs. Nestlé aims to provide portion guidance on all children's and family products by 2015 and by the end of 2013 products with sales of SFr 12.6bn already had specific portion guidance. Unilever launched a range of Mini-format products across its ice cream range in 2013-14, including smaller versions of its Magnum varieties, whereas Nestlé has launched smaller versions of some of its ice creams as well as confectionery such as Butterfinger and KitKat. Danone and General Mills both introduced 5.3 ounce cups of Greek yogurt, causing Chobani,

which was selling 6-ounce cups, to shrink the size of its standard portion to 5.3 ounces.

**Many packaged food companies continue to target simpler, healthier ingredients.** This could potentially reduce the reliance on forms of more heavily process sugars such as high fructose corn syrup (HFCS). For example, recent press reports have suggested that Hershey "may replace corn syrup with sugar in some products." However, as reported by foodnavigator.com (November 11) the growth of 'No HFCS' claims appears to be slowing with 2.35% of 20,000 new products launched in the US in 2013, making this claim up only 0.05% compared to 2012, compared to a step up of 0.21% in 2011-12 and 0.53% in 2010-12. The majority of products do not make this claim in isolation but are more likely to have additional health-focused claims (e.g. no additives/preservatives).

### The sugar content of products is also being reduced.

Nestlé's published Policy on Sugar states that it aims to reduce the sugar content by an average of at least 10% over the 2014-16 period in those products that do not meet its criteria for sugar as defined in the Nestlé Nutrition Profiling System. In effect this means that the group is trying to gradually lower sugar content in existing products – hoping to habituate consumers to lower sugar content. The company claims to have reduced table sugar in its products by 32% in the 2000-13 period. An example of the group's targets is to have reduced the sugar content in any serving of children's or teenagers' breakfast cereal to nine grams or less per serving by 2015.

Danone is a participant in Partnership for Healthier America (PHA) in the US and as part of this targets a reduction of total sugar to 23 grams or less per 6 ounce serving in all products for children and 70% of the company's products overall. In 2013 the company for example reduced sugar content of Dannon Danimals smoothies by 25%.

**Providing more information to consumers.** Hershey announced plans in early 2013 to begin migrating its packaging toward front-of-pack labeling, which provides consumers with detailed nutritional information (calories, fat, sugar). While a step forward in the United States, similar measures are already broadly implemented across much of Europe. Nestlé will be implementing *Facts Up Front* for front of pack labeling, a voluntary initiative led by the Grocery Manufacturing Association representing leading food and beverage companies, including information on calories, saturated fats, sodium and sugar by serving. In Europe and North America Unilever aims for all its packaging to include

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energy per portion on the front of pack plus eight key nutrients and % Guideline Daily Amounts (GDA) for five nutrients on the back of pack.

The majority of these cases do not yet involve the outright reformulation of products to include less sugar, which we believe could ultimately take on a greater focus in the coming years. This may particularly be the case as the packaged food and beverage industries develop a broader range of “natural” alternative sweeteners, which can be substituted for the multiple artificial sweeteners that have historically been used as sugar substitutes but have fallen somewhat out of favor as consumers develop a greater appreciation for natural / non-processed foods.

## What is our base case for long-term growth in related parts of the sector?

While sugar oriented categories have historically been drivers of growth for the Food industry, this gap looks likely to narrow going forward, with trends in Food consumption increasingly driven by Health & Wellness aspects as well as natural products – resulting in lower average sugar content per volume. In addition, as outlined above the industry is responding to consumer and regulatory pressures by working to gradually reduce sugar content. However, partly offsetting these impacts is consumers in EMs shifting towards processed (generally more sugar rich) foods as well as more ‘Westernized’ diets across regions.

## What would the impact be on growth and returns if governments regulated sugar consumption?

**While consumer preferences are shifting gradually, governments have recently begun to consider discouraging consumption through methods such as taxation.** While evidence is so far not clear on the impact of these types of actions, they could over time result in lower volumes for Food producers exposed to targeted categories (confectionery, snacks etc.) as well as those who do not reformulate products with higher sugar content in other categories.

Mexico recently instated a VAT on numerous sugar products such as flavored beverages, gum, and foods with high caloric density. The government in April 2014 also presented new labeling regulations requiring sugar and other content to be listed as percentage of recommended daily intake rather than just weight. So far the impact has been highest among sugary

beverages with declines of ~10% thus far in 2014. While selected products (e.g., Mondelez’s Tang powdered beverage, Mead Johnson flavored milk modifiers) were able to avoid taxation through proactive product reformulations, there has been some initial evidence of lower consumption in categories such as cookies and ready-to-eat cereal. A number of other countries have already introduced some form of sugar taxes including Denmark, France, Finland, Hungary and India.

## What would the impact be on growth and returns if sugar consumption does moderate?

It is difficult to know exactly what the impact would be on the sector as a whole, with significant differences between categories likely. However, we may see a divergence in growth between those companies who are proactively reducing sugar content and those who predominantly manufacture products with a high amount of sugar. We think that an important aspect of this development will be trends in categories not obviously high in sugar content (i.e. outside of areas like confectionery, snacks etc.) with companies lowering sugar content in these areas being well positioned to gain an advantage. Lowering sugar content in Food products does in general require using higher cost substitutes (artificial sweeteners, sugar enhancers etc.), which could in theory impact profitability and returns in some categories. However with growing volumes, costs of these replacements have come down, as for example with sucralose.

*Morgan Stanley is acting as financial advisor to JAB Holdings s.a.r.l. (“JAB”) in relation to the intention of D.E Master Blenders 1753 B.V. to combine with the wholly owned coffee business of Mondelez International, Inc. to create a new pure-play coffee company, to be called Jacobs Douwe Egberts, as announced on May 7, 2014. Morgan Stanley is also providing financing services to Jacobs Douwe Egberts.*

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## MCOs and Hospitals

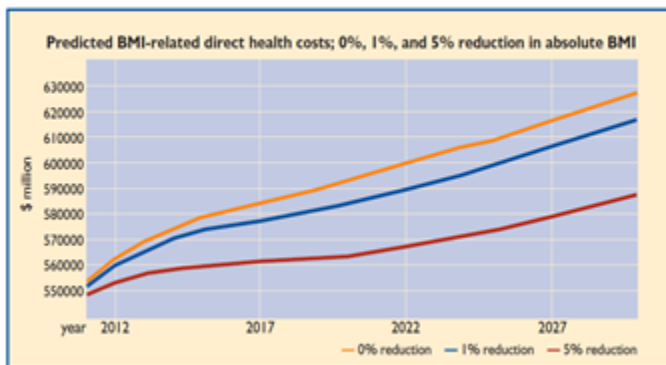
Andrew Schenker  
Vikram Ashoka  
Cornelia Miller

**Modest reductions in diabetes and obesity prevalence rates associated with reduced US sugar consumption can have material long-term implications for MCOs and Hospitals.** Specifically, the American Heart Association estimates the total excess costs related to adolescent obesity in the US in 2013 was ~\$254bn; should current trends persist, total healthcare costs attributable to obesity would reach \$861bn to \$957bn by 2030. Similarly, the American Diabetes Association estimates the total annual cost of diagnosed diabetes at \$245bn. Simply, the sheer magnitude of the cost pressure these conditions place on the US health system make hospital and MCO earnings sensitive to potential shift(s) in prevalence rates.

Exhibit 83

### Obesity costs expected to grow significantly through 2030

Body Mass Index-Related Health Costs Predicted from 2010 to 2030



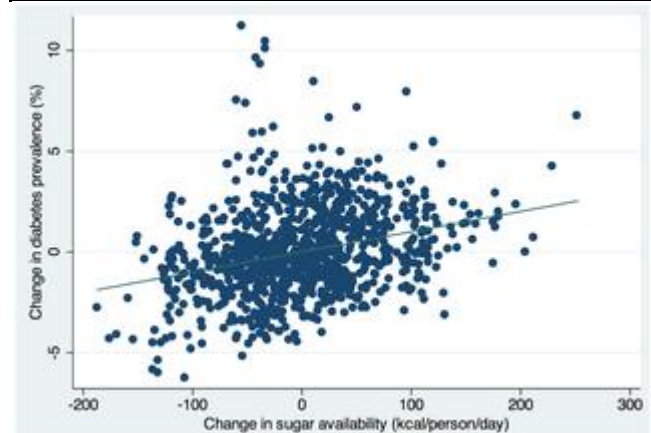
Source: RWFJ, Company Data, Morgan Stanley Research

**Medical research supports the hypothesis that sugar consumption increases predisposition to diabetes and obesity.** Although obesity and diabetes are a by-product of socioeconomic, cultural, and hereditary factors, medical research continues to provide increasing evidence that sugar consumption is a key underlying risk factor. In fact, a prominent study conducted by Dr. Sanjay Basu found duration and degree of sugar intake, as well as availability correlated significantly with diabetes prevalence. Statistical analysis suggests that for every 150 kcal/person/day increase in sugar availability is associated with increased diabetes prevalence of 1.1% ( $p < 0.001$ ), after controlling for selection biases including, diet, socioeconomic variables, and obesity.

Separately, a large body of medical research continues to identify a connection between fructose consumption, especially when consumed in liquid form, and weight gain or obesity. ([Basu et. al](#))

Exhibit 84

### Association of sugar availability with diabetes prevalence



Source: 2013 Basu et al, Company Data, Morgan Stanley Research

**We think MCOs will be a potential beneficiary from reduced US sugar consumption.** According to the American Heart Association, a significant portion of total cost of diabetes care, or 34.4% of the \$245bn in annual spend, is borne by commercial payors. With obesity and diabetes cost trend displaying minimal signs of moderation and federal/state governments increasingly looking to managed care as a source of saving, the potential benefit from reduced sugar consumption should provide welcome relief from these rising cost pressures.

In fact, analysis by the Trust for America's Health and Micro Health Simulations suggests that a 5% reduction in US obesity prevalence rates may result in cost savings of \$29.8bn in 5 years rising to \$611.7bn in 20 years, illustrating the substantial cost savings opportunity that may materialize.

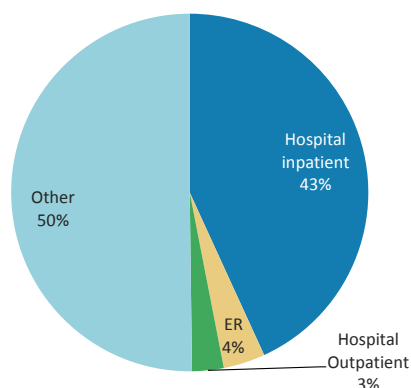
**Hospitals appear to have substantial exposure to diabetic and obese patient populations.** Given that diabetes and obesity are not mutually exclusive conditions, it is not surprising that analysis conducted by the American Diabetes Association and Health Affairs suggests hospitals have considerable exposure to these conditions. Specifically,

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research by Health Affairs suggests obese individuals have 46% higher inpatient costs. Furthermore, the American Diabetes Association estimates that Hospital Inpatient, Outpatient, and ER costs compose ~50% of total US spend on Diabetes.

Exhibit 85

## Hospitals bear a significant portion of diabetes costs



Source: American Diabetes Association, Company Data, Morgan Stanley Research

**However, longer-term structural shifts in care delivery make assessing the potential impact of sugar intake on hospitals difficult.** In the current healthcare environment Fee-for-Service remains the dominant compensation structure for hospitals, where hospitals typically benefit from the higher rates of utilization seen in diabetic and obese patient populations.

However, long-term structural shifts are expected to drive greater integration and alignment of incentives between health systems and payors. Migration toward risk based payment models will result in health systems earnings being more levered to savings realized from reducing patient costs, rather than absolute volumes. In this environment, hospitals should benefit from the organic savings realized from the impact of reduced sugar intake. However, these risk based models are largely experimental today making it impossible to infer if the cost savings are sufficient enough to offset the corresponding reductions in hospital utilization.



## Global Pharmaceuticals

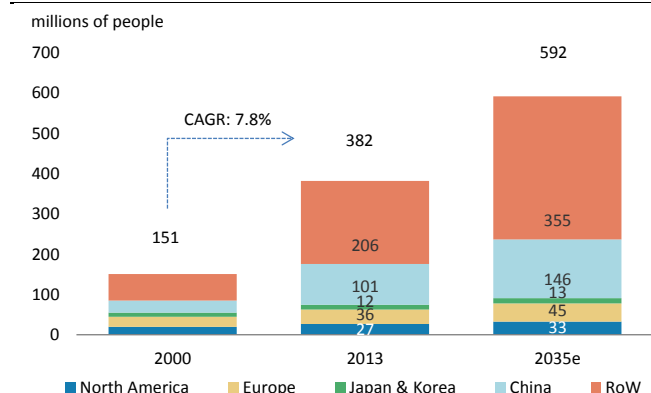
Vincent Meunier  
David Risinger  
Shinichiro Muraoka

### How is the sector exposed to sugar consumption trends?

Increasing global sugar consumption is a contributing factor to several health issues, mostly diabetes and obesity. Considered by WHO as an epidemic, diabetes has rapidly expanded over the past decade and is expected to increase by ~4x over 2000-2035, emerging markets being the strongest driver.

Exhibit 86

#### Emerging markets are expected to drive the diabetes epidemic in the next two decades



Source: Novo Nordisk, International Diabetes Foundation (IDF); Note: 20-79 age group

### Which companies are most exposed (% sales)?

The EU Pharmaceutical companies most impacted by the diabetes' mega trend are Novo Nordisk (80% of group sales), Sanofi (22% of group sales) and to a lesser extent AstraZeneca (7% of group sales) and Novartis (2% of group sales).

The US Pharmaceutical companies that are most exposed are Eli Lilly followed by Merck and then Pfizer. AbbVie and Bristol Myers do not sell drugs to treat diabetes.

In Japan, the highest weightings of diabetes-related sales are at Ono (25%), Takeda (5%) and Sumitomo Dainippon (5%). Ono and Takeda mainline in oral anti-diabetics such as DPP4 and SGLT2 inhibitors. Profit exposure is expected to rise for Mitsubishi Tanabe, where we expect diabetes products to furnish some 30% of EPS in 2018 (aided by growth in Invokana royalties from JNJ).

### What is our base case for long-term growth in related parts of the sector?

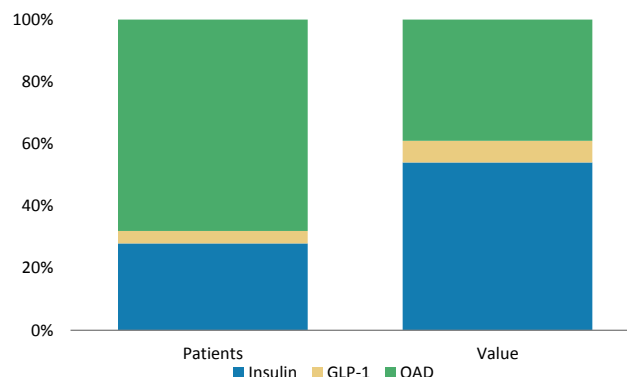
Diabetes is defined as the inability to manage blood sugar levels appropriately. It is a chronic disease, evolving in several decades, for which diet and exercise represent the primary medical approach. On top, drugs are used in multiple layers starting with oral anti-diabetics (OAD), followed by GLP-1, and insulin being the ultimate and inevitable care option.

**Diabetes is a \$35bn market globally, expected to reach \$50bn by 2020 (Morgan Stanley estimate) driven by all therapeutic classes.** Novo Nordisk, Sanofi and Eli Lilly are the largest world producers of insulin, the largest segment in value, and we expect this oligopoly to maintain its leadership in the next decade (Novo Nordisk and Lilly extending market shares at the expense of Sanofi) yet with relatively limited innovation.

Several companies are producing OAD, including Merck & Co, AstraZeneca, Lilly, Novartis, Takeda. Thanks to a sustained innovation over the past decade, new classes of drugs (DPP4, SGLT2) are expected to fuel a high single digit sales growth for OAD in the next decade.

Exhibit 87

#### Insulin is the most important segment in value in the diabetes market



Source: Novo Nordisk, IMS PharMatrix claims data, IMS disease analyser, IMS Midas; Note: OAD = Oral anti-diabetic drugs; Patient distribution across treatment classes is indicative and based on data for US, UK, Germany and France.

**As a disease, obesity is certainly overlooked.** With around 35% of the US adult population clinically obese (BMI>30) and more than 50% being overweight, the cost of obesity to the US health care system is estimated at \$147 billion annually with continued growth, according to Finkelstein et al.<sup>61</sup>

Exhibit 88

## Around 158 million patients are obese in the US

Million people	Overweight BMI 25-29.9	Obese			Total
		Class I BMI 30-34.9	Class II BMI 35-39.9	Class III BMI 40+	
Normal Glucose	39	17	7	-	62
Pre-Diabetes	34	21	10	9	74
T2DM	7	6	4	4	22
<b>Total</b>	<b>80</b>	<b>44</b>	<b>21</b>	<b>13</b>	<b>158</b>

Source: Novo Nordisk, NHANES and revised 2011 CDC estimates

However, the drug obesity market is worth only \$150m, dominated by generics of phentermine (an appetite suppressant derived from amphetamine), the most important being:

- Lack of recognition on part of patients and physicians that obesity is a disease; only ~20% of obesity cases are diagnosed
- Low proportion of obese people being treated – only ~3 million people, or ~3% of the total adult obese population
- Lack of adherence to treatment among this population of patients
- Lack of drugs that bring clinically meaningful weight loss with a balanced efficacy/safety profile

In obesity treatments, Takeda and Eisai have a presence but sales contributions are small (4% or less of total even in 2018). Takeda launched Contrave in the US in October 2014, following Eisai's Belviq in July 2013. Belviq has struggled from the outset and has little prospect of evolving into a major product in the longer run either (we forecast 2018 sales of \$210mn). Contrave has made a decent start but here too we only forecast 2018 sales at \$100mn. The two reasons for our conservative forecasts in relation to obesity drugs are (1) inadequate insurance coverage, and (2) the need to balance efficacy with safety. In addition, we currently see low market potential outside of the US (on grounds of insurance, price, etc).

We believe that Novo Nordisk's Saxenda, approved by the US FDA in December 2014, has the opportunity to unlock this market. Assuming a launch early 2015, we expect Saxenda to generate \$1bn of sales by 2020, equating to 10% growth over 2014-20. Despite being an injectable drug competing against

three pills recently approved (Orexigen's Contrave in Sept. 2014, Arena/Eisai's Belviq and Vivus' Qsymia both in 2012), Saxenda is expected to benefit from a differentiated, medical positioning, the same molecule being also approved in diabetes.

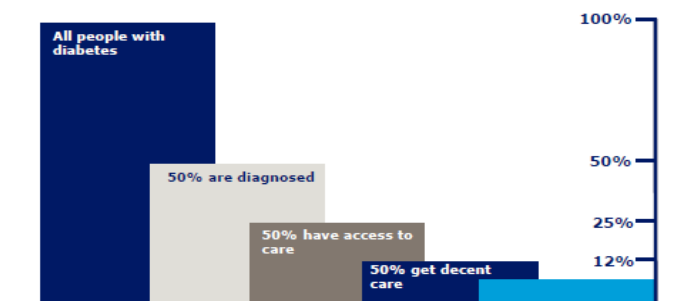
We see two major challenges for further development of the diabetes and obesity markets:

1. Market penetration: It is estimated that only ~12% of diabetics get decent care and 6% are controlled. As mentioned earlier, diagnosis for obesity is not consistent, with only 3% of patients been treated.
2. US pricing: The US diabetes market has already shown signs of weakness with regards to pricing, leading to Sanofi's profit warning in 3Q14.

We expect this environment to remain challenging for all the players involved in the insulin market. This is notably due to upcoming launches of new generation insulins by Sanofi (Toujeo) and Novo Nordisk (Tresiba) with relatively limited differentiated profiles, and the launch in mid-2016 of Lilly's copy of Lantus, in the context of structural changes in the US market as described in our [Sector Outlook 2015](#) note.

Exhibit 89

## Diagnosis, medical access poor glycaemic control remain global challenges – Novo's rule of halves



Source: Novo Nordisk

## What would the impact be on growth and returns if governments regulated sugar consumption (e.g. through taxes)?

Given the massive unmet medical need and low penetration, we estimate that the main driver for a winners and losers scenario is pricing.

In a scenario where governments intervene to cap or reduce sugar consumption, we think that pricing pressure on anti-diabetics might materialize, with a negative impact on all the players involved. Short term, we would see a more important risk for Sanofi vs Novo Nordisk.

<sup>61</sup> Finkelstein et al, Health Affairs 28, no. 5 (2009): w822-831

## What would the impact be on growth and returns if sugar consumption does moderate?

Given the massive unmet medical need and low treatment penetration, we believe that a more moderate sugar consumption would have very limited impact on growth and returns for pharmaceutical companies, at least in the next decade for the key following reasons:

- only approximately 20% of overweight individuals are successful at long-term weight loss (defined as losing at least 10% of initial body weight and maintaining the loss for at least 1 year).<sup>62</sup>
- while it is estimated that the prevalence of childhood overweight and obesity has more than doubled in the past 25 years<sup>63</sup> and that 50-75% of obese children become obese adults<sup>64</sup>, today's obese children will constitute tomorrow's obese adults.

*Morgan Stanley is currently acting as financial advisor and providing financial services to Abbvie Inc. ("Abbvie") with respect to its definitive agreement to acquire Pharmacyclics Inc. ("Pharmacyclics"), as announced on March 4, 2015. The proposed acquisition is subject to the successful tender of a majority of outstanding shares of Pharmacyclics' common stock, customary closing conditions and regulatory approvals. This report and the information provided herein is not intended to (i) provide advice with respect to whether to tender Pharmacyclics shares, (ii) serve as an endorsement of the proposed transaction, or (iii) result in the procurement or exchange of a security by a security holder. Abbvie has agreed to pay fees to Morgan Stanley for its services, including transaction fees and financing fees that are contingent upon the consummation of the proposed transaction. Please refer to the notes at the end of the report.*

<sup>62</sup> Wing et al, Am J Clin Nutr. 2005 Jul;82(1 Suppl):222S-225S

<sup>63</sup> Whitlock et al, Pediatrics. 2005 Jul;116(1):e125-44

<sup>64</sup> Clarke et al, Crit Rev Food Sci Nutr. 1993;33(4-5):423-30

## EU MedTech & Services

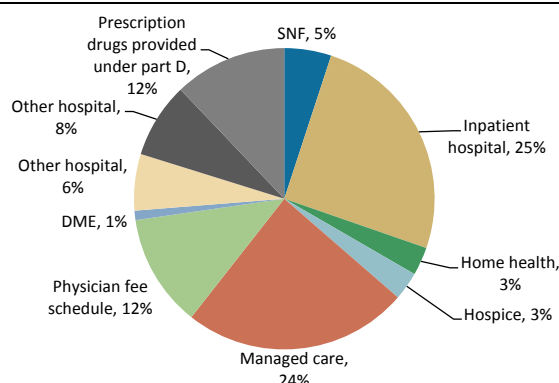
Michael Jungling  
Patrick Wood

### How is the sector exposed to sugar consumption trends?

**Sugar consumption and rising obesity is a key source of demand for medical devices and healthcare services.** Companies in the Medtech sector make medical devices to address various disease states, which can include areas such as heart disease, osteoporosis, oncology, hearing and eye care. Services companies provide healthcare services such as hospitals, dialysis and nursing homes. Both MedTech and Services derive procedure volume and thus revenues from patients who need medical attention, driven by various disease states. The Exhibit below highlights the spending by US Medicare on various services; each of the categories contains costs related to disease caused by high sugar consumption and obesity. For instance inpatient hospital includes dealing with chronic diseases such as heart disease, diabetes and obesity.

Exhibit 90

### US Medicare Spending by Service – Total Spend \$562bn



Source: Medpac 2012, Morgan Stanley Research

Eating too much sugar raises the risk of gaining weight, which then raises the risk of suffering from chronic diseases such as diabetes, heart disease and cancer but also other conditions such as high blood pressure, stroke, gallbladder, liver disease, osteoarthritis, gynecological problems, respiratory problems and sleep apnea according to the US Centers for Disease Control and Prevention.

### Which companies are most exposed (% earnings/ value per share)?

**European companies have a medium to low exposure to sugar-related diseases.** When looking at the European MedTech and Services sector, we are dealing with relatively unique characteristics compared to other geographies such as the US. More of a function of coincidence, European MedTech companies are exposed to hearing, radiation oncology, orthopedics, sports medicine, wound management, corrective lenses, in-vivo diagnostics, in-vitro diagnostics (IVD), biosciences and injectable generics.

The device companies which do have exposure fall into the 'medium' category (see Exhibit below) and include **Elekta** (100% of earnings relate to cancer), **Smith & Nephew** (about 25% of sales relate to Wound Care sales of which some sales address hard to heal wounds such as diabetic foot ulcers), **Fresenius** (offers clinical nutrition and pharmaceuticals related to chronic conditions – we estimate at ~25% of group EBIT; dialysis is ~30% of group EBIT), **Coloplast** provides Ostomy products for patients with cancer related to the intestines (we estimate at ~50% of group EBIT), while **Getinge** provides capital equipment and some consumables related to operating theatres as well as heavy lifters for patients (we estimate relevance at ~50%).

Exhibit 91

## MedTech & Services Exposure to Sugar / Obesity

Segment	Exposure	Companies
Dialysis	High	FMC, Fresenius
Diabetes	High	
Stents	High	
Hospital Services	High	Spire, Fresenius
Radiation Oncology	Medium	Elekta
Advanced Wound Care	Medium	Smith & Nephew
Orthopedic Recon	Low	Smith & Nephew
Defibrillators	Medium	Sorin
Injectable Generics	Medium	Fresenius
Pacemakers	Medium	Sorin
Diagnostic Imaging	Medium	Philips, Siemens
Clinical Nutrition	Medium	Fresenius
General Capital Equipment	Medium	Getinge
Hospital Supplies	Medium	Fresenius
Ostomy	Medium	Coloplast
General Dentistry	Medium	
Corrective Lenses	Low	Essilor
Cochlear Implants	Low	Sonova
IVD	Low	bioMerieux, DiaSorin
Hearing Aids	Low	Sonova, William Demant, GN
Biosciences	Low	Grifols
Esthetics	Low	
Incontinence	Low	Coloplast
Orthodontics	Low	
Orthopedic Spine	Low	
Orthopedic Trauma	Low	Smith & Nephew
Traditional Wound Care	Low	
Dental Implants	Low	Straumann

Source: Morgan Stanley Research

Of the medical services companies **Fresenius Medical Care** has virtually all of its revenues indirectly related to diabetes and cardiovascular issues. With **Spire** we estimate that +80% of its EBIT has some association with diabetes/obesity, which includes its largest segment of orthopedic joint reconstruction, where obesity can lead to early hip and knee joint wear.

## How is the sector currently responding to the obesity trend?

**The worldwide medical device industry is investing heavily in R&D, directly and indirectly related to diabetes and obesity.** Direct investment is going into creating an artificial pancreas, which is able to mimic the diseased pancreas and help patients move away from self-injection of insulin. To help reduce obesity, investment is also going into gastric bands, to help patients reduce food consumption. Indirect investment is going into medical devices that target e.g. cardiovascular disease, which may be a function of obesity. These can include products such as more and more sophisticated cardiac rhythm management products, stents

which can reduce a re-intervention or dialysis products and medical algorithms, which can improve clinical outcomes. On the medical services side, it is less a function of R&D and more related to expanding capacity to treat a growing population with chronic diseases. This involves building new clinics and/or hospitals and becoming better at implementing best practice for treating the disease. More recently we are also observing integrated care initiatives, whereby multiple healthcare systems (hospitals, insurance companies, governments, primary care) are working more closely together to help drive efficiency and reduce the ever growing cost of treating patients with chronic diseases.

## What is the base case for long-term growth in related parts of the sector?

**Our base case is for current sugar consumption levels to continue.** We do not expect any meaningful increase in sugar consumption across our coverage universe; however neither do we (nor do we think consensus) expect any material decline in sugar consumption. Any substantial decline in sugar consumption and commensurate fall in obesity could provide downside risks to our estimates in a number of sectors, including Dialysis Care (Fresenius Medical Care), Hospital Equipment (Getinge), Orthopedics & Wound Care (Smith & Nephew) and other related chronic diseases (Spire).

## What would the impact be on growth and returns if governments regulated sugar consumption?

**Government regulation of sugar consumption, for example through taxes, would likely be a net negative for our coverage universe.** Whether the tax targeted food producers or consumers, it would likely increase the price of sugary foods, thereby reducing consumption and potentially obesity. This could drive reduced demand for a number of medical devices and services offered by our companies (see next section), albeit delayed by a number of years. If sugar consumption volume were not to decrease, depending on the severity of the tax, this could potentially reduce consumer spending power, reducing demand for products supplied by the non-reimbursed healthcare companies (e.g. lenses, dental implants etc.), though we would expect this effect to be very marginal.

## What would the impact be on growth and returns if sugar consumption does moderate?

As a net beneficiary, whether directly or indirectly, a fall in sugar consumption would be marginally negative for many of the above companies in the EU MedTech and Services industry. Indeed, while hard to quantify, the impact on growth would intuitively be marginally different for each of our subsectors / companies:

- **Fresenius Medical Care:** Data from the US Department of Health indicates that almost 44% of incidences of kidney failure are derived from Diabetes, with another 27% linked to hypertension. This suggests that over two-thirds of Fresenius' patient base may be driven indirectly by sugar consumption. This suggests a decline in aggregate consumption could have a meaningful impact on FMC's organic sales growth, which has averaged at around +5% for much of its recent history.
- **Getinge:** The Extended Care division (27% of sales), which provides hospital beds and bariatric care, would be most directly affected by a fall in sugar consumption / obesity. With the connection between sugar consumption and hypertension, Getinge's Medical Systems business (53% of sales) could also be impacted as lower rates of cardiovascular disease would drive reduced demand for cardiovascular stents.

- **Straumann:** With sugar consumption connected to tooth decay, any fall in demand could drive reduced demand for Straumann's dental implant systems.
- **Smith & Nephew:** Data from the Canadian Joint Replacement Registry indicate that the need for total knee arthroplasty is 8.5x higher in patients with a BMI over 30 and 32.7x higher for those over 40; furthermore obese patients require treatment on average 10 years before those with a BMI in the normal range. While hard to quantify, this suggests that Smith & Nephew's business may be negatively impacted by any falling obesity rates from lower sugar consumption.
- **Spire:** Around half of Spire's group revenues are driven by orthopaedic procedures and, as per the comments above in Smith & Nephew, any fall in sugar consumption should be seen as a net negative to growth.

While the commentary above principally relates to growth, we would expect this to be the main impact on returns (asset turn), as on the whole we would expect only a small margin difference in aggregate for treating obese patients versus other sources of growth (age etc.). We would also expect any increase in sugar consumption to be a net positive for the companies for the same reasons.



## Appendix: From White Gold to Demon

**The jungle of sugar.** Perhaps because glucose is so important as a source of energy, in nature, sweetness is often an indicator of food that is safe to eat, compared with poisonous fruits and plants, which tend to be bitter. Plants use nectar and fruit, which are rich in sugars, to attract insects; bees use nectar to produce honey, which we eat. However, there is not just one type of sugar as sugar comes in various shapes and with different names (Exhibit 92).

Exhibit 92

### Classifications of sugar by type

Class	Subgroup	Principal components
Sugars (1-2)	Monosaccharides	Glucose, fructose, galactose
	Disaccharides	Sucrose, lactose, maltose, trehalose
	Polyols (sugar alcohols)	Sorbitol, mannitol, lactitol, xylitol, erythritol, isomalt, maltitol
	Free sugars	All monosaccharides and disaccharides added to foods by the manufacturer, cook, or consumer; sugars naturally present in honey, syrups, and fruit juices
Oligosaccharides (3-9)	Malto-oligosaccharides (a glucans) Non-a glucan oligosaccharides	Maltodextrins Raffinose, stachyose, fructo and galacto oligosaccharides, polydextrose, inulin
Polysaccharides (>10)	Starch (a glucans)	Amylose, amylopectin, modified starches
	Non-starch polysaccharides	Cellulose, hemicellulose, pectin, arabinosylans, $\beta$ glucan, glucomannans, plant gums and mucilages, hydrocolloids

Source: Lisa Te Morenga et al., Dietary sugars and body weight: a systematic review of meta-analyses of randomised controlled trials and cohort studies, BMJ 2013;346:e7492, 2013, Morgan Stanley Research

**Sugar can be natural...** Many sugars are found naturally in foods e.g. fruit (fructose) and milk (lactose). Milk is also the only animal food with carbohydrates. Vegetables contain different types of sugar such as glucose, sucrose and starch.

**... simple or complex ...** Glucose, fructose and galactose (a component of lactose) are simple sugars (monosaccharides) as well as maltose, lactose and sucrose (disaccharides, also known as double sugars because they are formed by two monosaccharides). Other forms of carbohydrates are more complex such as starch or glycogen (polysaccharides, which are made of a long chain of glucose molecules).


**... added...** Table or granulated sugar, which is more familiar to us, is sucrose: it is extracted from plants and processed. It is generally referred to as 'added sugar' (or extrinsic) to differentiate it from any sugar that is contained in fruit and vegetable (intrinsic). To date, sucrose is still the most widely used form of sweetener for personal use and in the food and beverage industry.

**...or hidden!** With this variety of sources, it is very difficult to keep track of how much sugar an individual consumes on a daily basis. An additional problem is that sugar is widely used as a preservative or a flavor enhancer in processed and packaged food. It is often added to products to make them more palatable (especially low-fat products) (Exhibit 93). For example, a tablespoon of Ketchup tomato sauce contains 4 grams of sugar (1 teaspoon); a cup of ready-made tomato

sauce can contain as much as 6 teaspoons of sugar. Even bread contains sugar (including brown bread, where it is often added to cover the bitter taste of wholemeal flour), and medicine pills are sugar-coated. On product labels, sugar is sometimes included in 'carbohydrates' so it is difficult to work out the sugar content. Fruit juices, which are perceived as a healthier option to soft drinks, have high sugar content and even vegetable juices, which are marketed as a cleanse or to detox, have a high fructose content to appeal to the 'sweet tooth'. Finally, wine and champagne also have high levels of 'hidden sugar' as they derive from the fermentation of the sugar found in grapes.<sup>65</sup>

Exhibit 93

### The hidden sugar



	Calories	Sugar (g)	Teaspoons
Starbucks caramel Frappuccino with whipped cream & Skimmed Milk (Tall)	273	44.3	11
Coca Cola Original (330ml)	139	35	9
Pepsi Regular Cola (330ml)	142	35	9
Mars chocolate bar (51g)	230	30.4	8
Muller Crunch Corner Strawberry Shortcake Yogurt (135g)	212	23.6	6
Sharwood's Sweet & Sour Chicken With Rice (375g)	420	22.1	6
Cadbury Hot Drinking Chocolate with Semi-Skimmed Milk (200ml)	160	22.1	6
Yeo Valley Family Farm 0% Fat Vanilla Yogurt (150g)	120	20.9	5
Solero Exotic Ice Cream (88ml)	94	17	4
Kellogg's Frosties with Semi-Skimmed Milk (30g)	172	17	4
Butterkist Toffee Popcorn (25g)	105	16.5	4
Glaceau Vitamin Water, Defence (500ml)	65	15	4
Heinz Classic Tomato Soup (300g)	171	14.9	4
Ragù Tomato & Basil Pasta Sauce (200g)	80	13.8	3
Kellogg's Nutri-Grain Crunchy Oat Granola Cinnamon Bars (40g)	186	9	2
Pot Noodle Curry King Pot (114g)	507	7.6	2
Heinz Tomato Ketchup (15ml)	18	4	1
Heinz Salad Cream (15ml)	50	2.6	0.7
Hovis Soft White Bread Medium (40g)	93	1.4	0.4

Amounts of sugar - both added and natural - per portion

Source: Action on Sugar

**'Added sugar' is not new to our diets.** The rise of sucrose in our diets began only about two centuries ago. It is thought that the Polynesians in the islands of the Pacific Ocean discovered a giant grass that contained a sweet tasting liquid that could be added in the preparation of food over 5,000 years ago.<sup>66</sup> Nevertheless, an expansion of sugar production in large quantities only began in the 18<sup>th</sup> century, with the setting up of sugar plantations in the West Indies and Americas. Lower prices boosted consumption. As a result, sugar farming became so profitable that sugar was dubbed the 'white gold'. Thereafter, its increasing fortune has been closely associated with industrialization, increased personal income and the consumption of beverages to which people add sugar, such as tea, coffee, and cocoa.

Sucrose is made of two molecules (glucose and fructose) which are combined together. It is concentrated in sugar cane and sugar beet, which are the main plant sources of commercial sugar. Once fully refined sugar, the consumer cannot tell the difference nor from which of the two plants it is derived. But despite the identical end result, the methods of production of

<sup>65</sup> We will not cover alcoholic drinks in the rest of this note.

<sup>66</sup> Sugar Nutrition UK

sugar from cane or beet industries differ significantly, with different distinctive histories and geographies.<sup>67</sup>

- **Sugar cane** is a perennial grass, which is cultivated primarily in tropical and subtropical climates. It matures in 12-16 months. It is the world's largest crop by production quantity. Brazil, India, China, Mexico, Australia, Thailand, Pakistan and the United States are the largest producers in the world. It accounts for about 80% of sugar produced globally.
- **Sugar beet** is grown mainly in temperate zones of the Northern hemisphere and accounts for the balance of sugar production. Prior to 1990, its production share was about 40% but shrank over the past 20 years because of comparatively lower costs of sugar cane production. Main producers are the European Union, United States, Russian Federation, Turkey, Ukraine, Iran, Japan and China.
- **Sugar and syrups** are also produced from the sap of certain species of maple trees, from sweet sorghum, when cultivated explicitly for making syrup and from sugar palm. In recent years, ever larger quantities of cereals (mainly maize) have been used to produce sweeteners derived from starch and a substitute for sugar known as isoglucose or high-fructose corn syrup (HFCS). The latter is widely used in processed food, soft drinks and cereals.

**Production Process: modern sugar mills extract sugar from cane and beets and refine the sucrose into products fit for human consumption.** Shortly after harvest, cane and beets are transported to mills where they are first washed to remove debris. Mills crush the cane or slice the beets and expose them to hot water to extract the sucrose. The solution of sucrose is called juice or liquor, and is clarified via chemical reactions to precipitate out impurities. The purified juice, containing 15-20% sucrose, is partially evaporated to increase the concentration of sucrose to over 60% and "seeded" with sugar grains to foster the formation of sugar crystals. The resulting mixture of crystals and thick syrup, called massecuite, is loaded into a centrifuge that separates it into sucrose sugar crystals and molasses.

**All sugar feedstocks are not created equal.** In beet sugar production, the centrifuge is often the final step, with no further refining required. In cane sugar production, the resulting crystals are known as raw sugar, which requires further refining before being deemed fit for human

consumption as "white" sugar. Owing to the fact that it requires additional refining, raw sugar can be more easily transported in bulk than in bags and makes up the majority of global export volumes. In some cane-producing countries, mainly Brazil, mills are equipped to ferment cane juice to make ethanol, providing optionality beyond raw sugar production.

**The byproducts of sugar production are often a source of incremental value for sugar producers.** Cane sugar production produces two main byproducts: bagasse and molasses. The former is the cane stalk debris left over from crushing, which some mills burn in cogeneration facilities to power their operations or to generate electricity to sell to the local grid. Molasses can be used for animal feed, human consumption, or alcohol production.

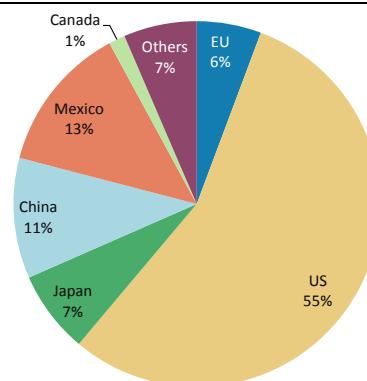
#### SUGAR CUBE #4:

##### HIGH-FRUCTOSE CORN SYRUP

High-Fructose Corn Syrup (HFCS) is a sweetener obtained through an enzymatic process, which alters corn syrup to convert some of its glucose into fructose (typically between 42% and 55% of total sugar, instead of the 50:50 balance of sucrose). It is used mainly in the US (the largest consumer and manufacturer) where it was first introduced for mass consumption in the 1970s, in response to higher sugar import prices. It enjoyed its golden age thereafter and by the mid-1980s, Coca-Cola Co and PepsiCo Inc were using it to sweeten most of their drinks. Since then, it has been used also in Japan, China, EU and Mexico (Exhibit 94). However, since the beginning of this century, its competitive edge has partly diminished and HFCS has suffered from negative publicity, especially in the US where consumption has declined due to health concerns, mainly in relationship to obesity. To date US Corn refiners have not been allowed to market HFCS as 'corn sugar' or 'natural sugar'.

Exhibit 94

#### Country share of HFCS total consumption, 2013



Source: OECD, Morgan Stanley Research

The consumption of sugar has increased significantly over the past century. At the beginning of the 20th century, a world population of 1.6 billion people consumed approximately 8 million tonnes of sugar, i.e. 5.1 kg per capita. Today, a world population of 7 billion consumes 165.6 mn tonnes of sugar

<sup>67</sup> [sugarindustrybiotechcouncil - sugar-beet-faq](#)

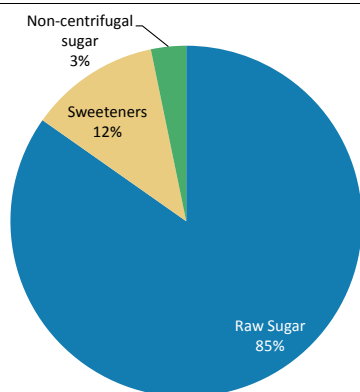
(including high-intensity sweeteners), that is 24kg per person (equivalent to around 230 k/calories per day or 8% of the total daily energy intake).

The FAO supply balance sheet data on 'sugar and sweeteners' are a good proxy for consumption and have the advantage of being available with long time series and wide geographical breadth. They include a variety of monosaccharides and disaccharides mainly consisting of sucrose, glucose, honey, HFCS as well as some artificial sweeteners. They measure sugar and sweeteners 'availability' (i.e. they are derived from the production data, plus imports and inventory changes and minus exports) and include sugar, which is either not consumed or wasted. The FAO series do not include natural sugars (although they include lactose produced commercially from whey). The figures also exclude the sugar crops in non-food industrial uses (i.e. mainly Brazil's sugar cane used in ethanol production)<sup>68</sup>.

**Sugar is still the king sweetener.** Of the total aggregate, raw sugar still is the leading sweetener (85%), followed by high-intensity sweeteners (12%) and non-centrifugal sugar (i.e. the product obtained by evaporating the water in the sugar cane juice; this residual is known by many names in different parts of the world such as panela, jaggery, muscovado) (Exhibit 95).

Exhibit 95

## Sugar and sweeteners split, 2011



Source: FAO, Morgan Stanley Research

<sup>68</sup> Different sources provide different orders of magnitude. For example, according to the US Department of Agriculture sugar per capita consumption (excluding sweeteners) was 22.9kg in 2013; using data from the International Sugar Organization the OECD estimates that sugar consumption was 24kg in 2013 and 25.8kg including consumption of HFCS. However, discrepancies at the national level are much smaller, suggesting that there might be issues in aggregating the data.

## SUGAR CUBE #5:

### HIGH-INTENSITY SWEETENERS

High-intensity sweeteners are low-calorie or calorie-free that are used instead of sugar to sweeten foods and drinks. They can be chemical or naturally-derived (Exhibit 96). They are found in thousands of products, ranging from drinks, chewing gums, ready meals and even toothpaste. In the EU, they are assessed and approved by the European Food Safety Authority and in the U.S. by the Food and Drug administration (FDA).

The relative sweetness of these products compared to sugar varies considerably (for example, ACE K and Aspartame are 200 times sweeter than sucrose) and some of them leave an aftertaste. Thus, manufacturers continue to experiment with a mix of ingredients to replicate sugar as closely as possible. It is not just a matter of taste, but also of finding surrogates that can replace other uses of sugar such as flavor enhancing, preservation and bulking, among others.

Recently, Stevia, a traditional South American herb, has gained popularity among consumers because of its natural connotation and its negligible effect on blood glucose. Although still a niche market (2% of high intensity-sweeteners by volume in 2013, according to Euromonitor), it showed exponential growth in recent years, following the US FDA approval of certain refined Stevia preparations in 2008 and the EU approval of Stevia in 2011.

Exhibit 96

## Selected types of high-intensity sweeteners

Name	Definition
Acesulfame K (Ace K)	200 times sweeter than sucrose, with a bitter after-taste. Used mainly in soft drinks but also in confectionery and toothpastes.
Aspartame	The methyl ester of the dipeptide of the amino acids, aspartic acid and phenylalanine. 200 times sweeter than sugar but has a less bitter after-taste than some of the other low-calorie sweeteners.
Saccharin	The oldest known high intensity sweetener. Initially used as a preservative but now an important sweetener in its own right. 300 times sweeter than sugar and with a bitter after-taste.
Stevia	Sweet compounds - glycosides - extracted from the leaves of the Stevia rebaudiana plant. The most common glycosides include rebaudioside A (reb A) and stevioside. Stevia extracts are at least 250 times sweeter than sugar, have no calories and do not negatively effect blood glucose concentrations, insulin levels or blood pressure. Used in soft drinks, dairy and confectionery.
Sucralose	Has only recently come to the fore as a food additive but is growing in popularity. 600 times sweeter than sugar and derived from sugar through a multi-step process that substitutes three chlorine atoms for three hydrogen-oxygen groups on the sugar molecule.
Cyclamate	One of the less intense of the high intensity sweeteners, cyclamate is just 30 times sweeter than sugar. As a result, it is often used in conjunction with other sweeteners.
Advantame	A free-flowing, water soluble, white crystalline powder that is stable even at higher temperatures and can be used as a table sweetener, as well as in cooking applications and as a flavour enhancer. Can be used in baked goods, soft drinks, chewing gum, confectionery, frozen desserts, jams and jellies, processed fruits and fruit juices, toppings and syrups.

Source: Euromonitor, Morgan Stanley Research

## How Sweet is a Country's Tooth?

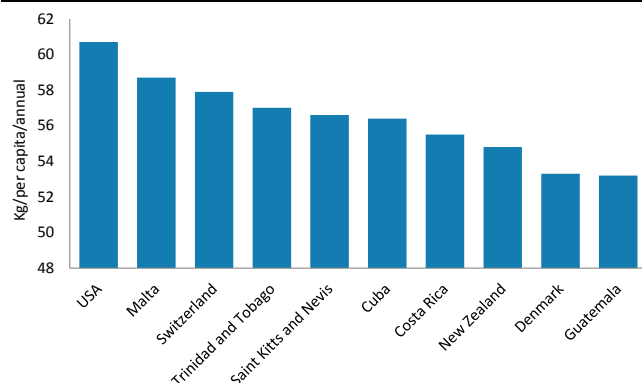
Consumption differences across regions and countries are significant and the picture changes significantly whether looking at aggregate consumption or per capita.

**By countries, the largest consumers are India, the EU, the US, China and Brazil, in order of magnitude.** In India (which is also the second largest global producer) sugar and sweeteners consumption has trebled since 1961 to 26.8mn tonnes. Growth has been remarkable also in China where consumption is now seven times higher than in 1961 at 9.3mn tonnes.

**Interestingly, over 70% of world sugar production is consumed domestically - the remaining is traded.** Brazil, India, China, Thailand, Russia, Mexico and Pakistan feature among the top-ten producing countries in the emerging world, therefore the same countries are also among the leading consumers (together with Indonesia and Egypt). Brazil and India are net exporters of sugar, whilst China, Russia, Indonesia and Pakistan are net importers, as well as all major developed countries (with the exception of Australia).

Exhibit 97

## Top ten countries ranked by Sugar consumption per capita (2011)



Source: FAO, Morgan Stanley Research

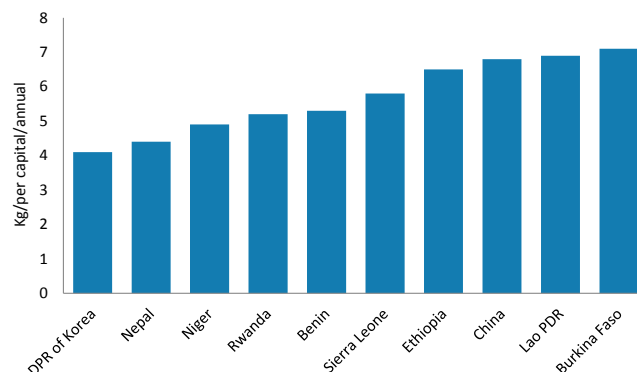
**A ranking by countries sees the US topping the list (60.7kg/pp/year).** Cuba was exceptionally high, exceeding 80 kg per capita around the beginning of the 1990s, but subsequently, consumption has fallen to 56.5kg per person, albeit still very high, now followed by Malta, Switzerland and a few Caribbean islands (see Exhibit 97). Within the EU, Denmark, Belgium, Ireland, Slovakia and Germany are leading consumers. Other very 'sweet-tooth' countries in the developed world are New Zealand, Australia, Canada and the UK. Among the emerging markets, Russia, Mexico, Chile and Brazil also have a comparatively high sugar propensity (Exhibit 99).

**At the bottom end of the spectrum, we find China** (7.4kg/pp/year) together with some very low- income Asian and African countries (Exhibit 98). On average in the least

developed countries per capita consumption amounted to 11.4kg/pp/year.

Exhibit 98

## Bottom ten countries ranked by sugar consumption per Capita (2011)

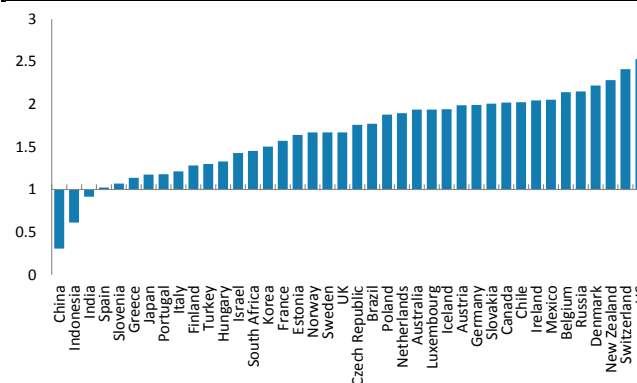


Source: FAO, Morgan Stanley Research

**Consumption in Indonesia and in India is also below the world's average although in India the gap is no longer big.** Other relatively low 'sweet tooth' countries are the EU Mediterranean countries (including Iberia), Japan and Slovenia (Exhibit 99).

Exhibit 99

## Sugar and sweeteners per capita consumption, OECD and BRICS countries versus the world's average



Note: A bar above 1 means that consumption is higher than the world's average. Indonesia is included in the BRICS.

Source: FAO, Morgan Stanley Research



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## Other Recent Morgan Stanley Research Based on AlphaWise Evidence

US Media/ Internet	03/12/2015	Ben Swinburne	<a href="#">5th Annual Streaming Video Survey, Part One</a>	Our AlphaWise 2015 survey reinforces our bullish view of NFLX on multiple fronts. Netflix gained nearly 500bps in reported usage vs. last year's survey while other services saw much smaller share gain.
NA REITs	03/11/2015	Haendel E. St. Juste	<a href="#">February Survey Results Show Improved Traffic, Higher Sales &amp; Pricing Expectations</a>	The February results of our monthly Morgan Stanley / HomeSphere AlphaWise survey indicate continued improvement in buyer demand and builder expectations around the Spring Selling Season.
NA Technology	03/11/2015	Katy Huberty	<a href="#">Apple, Inc. AlphaWise Tracker: iPhone Demand In-Line with Expectations</a>	Our AlphaWise Smartphone Tracker compiles sell-through data using web search analysis. Data through the end of February indicates March quarter iPhone demand is tracking to 55M units.
NA Retail	03/09/2015	Simeon Gutman	<a href="#">Home Furnishings Survey: BBBY Share Slippage Implies Comp Miss, but Promos Declining</a>	We conducted Wave 11 of our proprietary AlphaWise Home Furnishings Survey. Nine key takeaways including top-line risk for BBBY and less promotional activity.
EU Retail	03/09/2015	Edouard Aubin	<a href="#">UK Food Retail: AlphaWise Price Tracker Best prices at Tesco in nearly two years</a>	On a 3-month basis, our Tracker suggests Sainsbury's and Tesco's prices are at the same level, while the gap to Asda is at its lowest level since Summer 2013. ... which seems to validate the 'selective' price investment strategy currently implemented under Tesco's new management team.
EU Leisure	03/03/2015	Jamie Rollo	<a href="#">Cruise Lines "Cruise Chat": A Fab Feb?</a>	Our quantitative webscraping of cruise prices shows low single digit increases for all operators. Most lines, including Carnival and Royal Caribbean, also saw a nice increase in prices for last minute March sailings.
EMEA Technology	02/25/2015	Andrew Humphrey	<a href="#">Ingenico S.A: Survey Highlights US EMV Opportunity</a>	We conducted an AlphaWise survey of ~400 US small businesses, to understand smaller merchant behaviour ahead of the October 2015 EMV deadline. We view this migration as positive for POS vendors, including Ingenico, and few are prepared for it.

March 18, 2015  
Sustainable Economics  
The Bitter Aftertaste of Sugar

NA Technology      02/25/2015      Brian Nowak

[Yelp Inc : Productivity Poised to Surprise; Initiate OW, \\$62 PT](#)

Our AlphaWise survey gives us confidence that YELP can continue growing its paying customer count as YELP satisfaction rose to 90% in early '15 (up 800bp Y/Y) and SMBs intend to increase their YELP spending by 6% in the NTM.

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March 18, 2015

Sustainable Economics

The Bitter Aftertaste of Sugar

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