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The Food and Human Security Index: Rethinking Food Security and 'Growth'

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Abstract. The goals of this article are multiple: to challenge conventional understandings of food security; to show that economic growth per se cannot be relied upon to adequately feed the world; to convince critics of economic growth to pay closer attention to issues related to food in their assessments of 'development'; and to up-end established beliefs around the so-called Global North–South divide while confronting the belief that the latter must follow in the food-prints of the former. The author introduces the Food and Human Security Index (FHSI) with these ends in mind. A FHSI score is calculated for 126 countries by looking at indicators of objective and subjective well-being, nutrition, ecological sustainability, food dependency, and food-system market concentration. The ranking of scores has some counter-intuitive placements, which ought to be reflected upon as new lines are drawn around food security in the twenty-first century.

Introduction

Literally hundreds of definitions of food security are scattered throughout the literature. For example, a review from 20 years ago, the last of its kind to be conducted, yielded almost two hundred (Smith, et al., 1992). In a policy context, however, the concept shows less mutability. Agri-food policies over the last 60 years are said to have been aimed at improving food security; at least, that is how they have been framed (Mooney and Hunt, 2009). What precisely these aims are and whether they reflect a genuine improvement in food security will be addressed shortly. My point is that a relatively straightforward outline of the term can be discerned from the stated and implied aims of food and agricultural policy since the middle of the last century. As described in some detail below, this outline is the cumulative effect of three foci: the calorie-ization of food security (1940s to the present); the neo-liberalization of food security (1970s to the present); and the empty calorie-ization of food security (1980s to the present). It is this conceptual outline of food security that is challenged in this article. Using this food security yard-stick, the last 60 years have been

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a resounding success. According to the Food and Agriculture Organization (FAO), for example, the global food system produces 17% more calories per person than it did 30 years ago, even after factoring in for the 70% population increase. Yet these 'gains' have come at tremendous cost to the environment, individual and societal well-being, human health, and the food sovereignty of nations (e.g. see Dixon and Broom, 2007; Wittman et al., 2010; Carolan, 2011; Sage, 2011).

After reviewing briefly the outline of food security embodied by conventional agri-food policy and practices, an alternative is offered with the introduction and elaboration of the Food and Human Security Index (FHSI). The FHSI takes into consideration indicators for the following states/conditions:

- individual and societal well-being;
- ecological sustainability;
- food dependency;
- nutritional well-being; and
- food-system market concentration.

An FHSI score is calculated for 126 countries, allowing in turn for the ranking of countries. The ranking has its share of counter-intuitive placements, which challenge conventional understandings of food security. The article concludes discussing important issues brought to light by the FHSI ranking as we think about food security in the context of the twenty-first century.

Food Security: A Brief History[1]

In 1941, President Roosevelt gave perhaps the most famous State of the Union address of the twentieth century. In this speech, Roosevelt spoke of 'four essential freedoms' that are shared 'everywhere in the world': freedom of speech, of worship, from want, and freedom from fear. The founding conference of the FAO of the United Nations (UN) in 1943 drew specifically from Roosevelt's Address when it set out 'to consider the goal of freedom from *want* in relation to food and agriculture' (FAO, 1943, p. 1). While not using the term 'food security' outright, the organizers get close, as the proceedings discuss the need to 'secure' a 'suitable supply of food' (p. 1). Characterized as freedom from want, we find here one of the earliest conceptual framings of food security: essentially, the absence of abject hunger.

Calorie-ization of Food Security

For a variety of reasons, this 'want' was viewed principally as the result of underproductivity, most notably in less affluent parts of the world (though farmers in affluent nations were also encouraged to intensify their operations or risk falling off the agricultural treadmill; Cochrane, 1993). The solution was simple: agricultural systems needed to produce more (and so was born what is referred to elsewhere as the productivist ideology – see Buttel, 2005). The green revolution represents the actualization of a policy and research agenda informed heavily by this calorie-ization of food security. The green revolution was enacted through a series of research and technology transfer initiatives that took place immediately following World War II and lasting into the 1970s. The primarily goal of these initiatives centred on the development of high-yield varieties of a handful of cereals, which also required the expansion of the necessary irrigation infrastructures and input supply chains (fertilizer, pesticides, seeds, etc.).

Examples of the calorie-ization of food security are sprinkled throughout the literature (for additional examples, see Carolan, 2011, pp. 58–61). In a peer-reviewed article co-authored by a United States Department of Agriculture (USDA) plant scientist in the late 1990s, the green revolution is described as making a 'push toward food (i.e. *calorie* or energy) security' (Welsh and Graham, 1999, p. 9, my emphasis). More recently still, the USDA's *International Food Security Assessment 2011–21* (Shapouri et al., 2011, p. 2) explains in its methods section that the '[c]ommodities covered in this report include grains [which make up the vast majority of *calories* assessed], root crops, and 'other'… These three groups account for 100 percent of all *calories* consumed in the study countries and are expressed in grain equivalent. The conversion is based on *calorie* content' (my emphasis).

Yet, the calorie revolution was only the first of three cumulative foci in agri-food policy's alleged bid to enhance the food security of nations. Even die-hard proponents of productivism realized that astronomical increases in agricultural output could never feed the world if those calories were not efficiently allocated. And as the market has long been viewed as *the* mechanism for the efficient allocation of resources, a concerted push simultaneously took place in the mid- to late twentieth century (most notably from the 1970s to the present) to increase the integration of international markets for agricultural commodities. Complementing the earlier calorie-ization is the neo-liberalization of food security.

Neo-liberalization of Food Security

With the neo-liberalization of food security, countries were not all expected, nor were they even encouraged, to become self-sufficient in food production. Many were, in fact, aggressively instructed – with a variety of carrots and sticks – to abandon policies directed at such ends. Food security, as conventionally understood, has little to do with *farmer* security, especially when talking about small-holders in low-income countries. Quite often policies claiming to be in pursuit of the former have been detrimental to the latter, as hundreds of millions of small-scale peasant farmers have been pushed out of agriculture (Bello, 2008; Carolan, 2011). Former US Secretary of Agriculture John Block made just this point in 1986, proclaiming, 'The idea that developing countries should feed themselves is an anachronism from a bygone era. They could better ensure their food security by relying on US agricultural products, which are available in most cases at lower cost' (quoted in Bello, 2008, p. 452).

Faith in the market to continually deliver cheap calories to the world's hungry has been so great in recent decades that countries have been instructed to abandon long-standing practices of surplus storage. Many governments also abandoned policies that previously helped support a robust domestic agricultural sector, leading to the dismantling of marketing boards, the elimination of subsidies for things like seed and fertilizer, and the cancelling of government credit programmes for small-scale farmers. Numerous countries that were at one time net exporters and/or food self-sufficient thus experienced a significant decline in domestic production as their borders became flooded with cheap imports from high-income nations that continued to heavily subsidize their agricultural sectors. Millions of small-scale farmers, subject to this unfair competition, have thus had little choice but to abandon agriculture. While done in the name of food security, the actual outcomes of these policies

– whether in terms of farm incomes, human well-being, or national food sovereignty – suggest otherwise. The short-sightedness of such policies has been made particularly clear with the recent volatility in food prices. Given that low-income households spend close to (or in some cases more than) half of their disposable annual incomes on food, price increases of the magnitude witnessed in recent years have crippled many of the world's poor.

Between 1950 and 1970, low income nations went from being entirely food self-sufficient to accounting for almost half of the world grain imports (Friedmann, 1990, p. 20). Harriet Friedmann (1992) gives a thorough account of the growth of food dependency through an analysis of the global wheat trade, noting that before World War II no African, Latin American, or South Asian country imported the commodity. Now all countries within these regions rely to various degrees upon wheat imports. For example, whereas Nigeria was entirely food independent up through the 1960s, one quarter of its total earnings went to importing wheat by as early as 1983 (Jarosz, 2009).

Another level of added complexity is the effect that these neo-liberalizing trends had on the internal dynamics of the food supply chain. Prior to trade liberalization, national food chains were often short and involved locally grown, seasonally available products. Global market integration (typically) means increases in capital intensity as the task of moving food from farm to table becomes increasingly complex. During this process localism and seasonality are displaced as investments tend to focus on commodities for export and/or 'value added' processed foods (some of which may be for domestic consumption).

The neo-liberalization of food security also has meant the liberalization of finance, which has increased the rate of foreign direct investment (or FDI). FDI is an investment by a firm in one country into a business located in another, leading to the former owning a substantial, but not necessarily a majority, interest (Hawkes, 2005). FDI is one of the primary mechanisms by which companies enter new markets. The rise of FDI marks yet another evolution in agri-food policy's response to hunger – termed, here, the 'empty calorie-ization' of food security.

Empty Calorie-ization of Food Security

Between 1988 and 1997, food industry FDI increased from USD 743 million to USD 2.1 billion in Asia and from USD 222 million to USD 3.3 billion in Latin America; totals that far-and-away outstripped investments in agriculture in these regions. Food companies in the US generate revenue that is at least five times higher through FDI sales than through export sales (Rayner et al., 2007). Highly processed foods possess certain characteristics that make them ideal (from an investment perspective) for FDI. For example, relative to trade, FDI can be a cost-effective way for firms to reach foreign food markets. Exporting highly processed foods can be cost prohibitive as transport and storage costs relative to the value of the product are high. Producing these foods in the host country for domestic distribution avoids many such costs. FDI also optimizes the effectiveness of branding and promotional marketing allowing companies – such as Nestlé, Coca-Cola and McDonalds – to benefit from economies of scale in marketing and advertising. Investing in well-known domestic brands is also advantageous for firms by giving them instant ownership over a brand already known in regional and/or national markets (Hawkes, 2005).

The rise of FDI has unquestionably led to the spread of 'cheap' calories (Carolan, 2011). In Argentina, for example, 18% of all food expenditures in 1996 were on meals eaten outside the home, up from a mere 8% in 1970. This increase correlates strongly with an increase in FDI in restaurant (and coffee, doughnut, ice-cream, etc.) chains and processed foods in the country (Hawkes, 2005). In Brazil, growth in the sales of hamburgers, pre-made desserts, yoghurts, and flavoured milk averaged 27% between 1993 and 1997, compared with 5% for products such as vegetable oils, margarines, poultry and pork. In other words, dietary patterns – and thus consumer 'choice' – track remarkably close with FDI trends (Farina, 2001; Zimmerman, 2011). In the late 1990s and early 2000s, nearly three-quarters of all FDI into Mexico was directed at the production of processed foods. During this period sales of 'snacks' increased annually roughly 12%, while 'baked goods' saw a 55% increase (Hawkes, 2006). More remarkable still is the increase in carbonated soft-drink consumption in this country, which grew from 44 to 61 Kcal per capita per day between 1992 and 2000 (Arroyo et al., 2004). Consumption of Coca-Cola increased from 275 8oz servings per person per year in 1992 to 487 servings in 2002 (that is more than the per person average – 436 servings – recorded in the US at the time) (Hawkes, 2006).

While the general public might not link the rise of fast-food restaurant chains and processed foods to enhanced food security such links *are* made by proponents of recent FDI trends. Two examples: 'In my opinion, obesity is more the result of the success – not the failure – of the market. But on net, we are still better off' (Finkelstein and Zuckerman, 2008, p. 10); 'We suspect that most people are better off from the technological advances of mass food preparation, even if their weight has increased' (Cutler et al., 2003, p. 116).

Whether people and societies are indeed 'better off' is an empirical question that deserves closer scrutiny. The empirics, to bring us back to a point made earlier, depend in significant part on the food security yard-stick used. If our yard-stick is cheap – a.k.a. 'empty' and 'incorrectly priced' (Carolan, 2011) – calorie availability, then I might agree with the authors of the above statements. But do calories alone a secure food system make?

Pivoting in a New Direction

International bodies such as the FAO and the World Health Organization (WHO) track national-level data on, for example, the prevalence of underweight children under the age of five and proportion of population below minimal level of dietary energy consumption. Yet these data merely confirm what we already know: that incredibly impoverished countries are terribly food insecure. It also tells us absolutely nothing about the food situation in high-income countries, leaving untouched the assumption that affluent nations must be food secure by nature of their wealth. Take a country like the United States (US), which looks to be awash in calories. The US has its share of food deserts (Hendrickson et al., 2006; USDA, 2009), like any higher-income nation (Furey et al., 2001; Shaw, 2006). Yet the very term food *desert* denotes a space that is radically different from its surrounding environment. To therefore even suggest that the *entire* country could be food insecure is absurd. Or is it?

Conventional understandings of food security privilege affluent nations – they fail to ask fundamental questions such as 'are conventional food-related practices sustainable? And 'what levels of well-being do they help generate'? A UN-sponsored book titled *Food Security* recently remarked that 'the extent of hunger and food insecurity [in the US] is much less severe than in the development world' (Dutta and Gundersen, 2007, p. 44). In the space of less than a sentence the affluent US is extoled while *the entire* 'developing' world is condemned on the basis of their respective levels of food security. Perhaps such pronouncements are empirically justified when food security is narrowly defined as, say, calories produced per capita. But would the statement still hold if we opened the definition up to variables that include such factors as individual and societal levels of well-being, diet, ecological sustainability, food dependence, and market concentration?

The Food and Human Security Index

The FHSI was developed to challenge conventional understandings of food security (e.g. the term 'human' in the index's title is a conceptual reminder that human welfare enhancement should be the ultimate goal of any food system). This macro-level index, which has been calculated for 126 countries, looks at indicators of individual and societal well-being, ecological sustainability, food dependency, nutritional well-being, and food-system market concentration. The FHSI is composed of national-level data for five indicator variables.

- *Life expectancy at birth*: indicator of individual and societal well-being.
- *Life satisfaction*: indicator of individual and societal well-being.
- *Total per capita water food-print as a percentage of total per capita renewable freshwater supply*: indicator of ecological sustainability and food dependency.
- *Daily per capita consumption of oils, fats and sugars*: indicator of individual and societal well-being, ecological sustainability, and nutritional well-being.
- *Supermarket concentration*: indicator of food-system market concentration.

This is not to suggest that quantitative macro-level indicators are the only – or even the best – way to measure food security levels across countries. Whether we like it or not, however, metrics matter. And what we measure affects what we do. Choosing to not think outside the food security box will only result in more of the same, which, while effective at enhancing global caloric output, has undermined many of the things that make our lives healthier, longer, happier, more sustainable, and, ultimately, more secure. That said, we should also be mindful of the limitations of national level metrics. Even if we could satisfactorily rank countries according to their levels of food and human security, we would not learn much from such an exercise without then following it up with a deeper analysis into *why* countries rank as they do. Unfortunately, space constraints restrict the amount of time that can be spent speaking to these important 'why' questions. The following discussion does, however, allow for some specifics to be covered while reviewing the indicators (and justifying their inclusion) making up the FHSI. Below, each indicator will be discussed, particularly its conceptual and empirical significance to food and human security.

Individual and Societal Well-being

Recall that the FAO's foundational principle of creating a freedom from want as it applies to food is directed at the achievement of deeper goals laid out by Roosevelt in his 1941 State of the Union Address during his discussion of the 'four essential freedoms'. The goal of these freedoms: human security and enhanced well-being. In keeping with its original spirit, *genuine* food security must enhance well-being. The FHSI includes objective and subject measures directed toward this end.[2]

The 'objective' measure is a country's average life expectancy at birth. There is a rich literature documenting the links between food availability, accessibility, and affordability and individual and societal levels of health; at least up to a certain level, after which over-consumption can have a negative effect on life expectancies (Medez and Popkin, 2004; Monteverde et al, 2010). Dietary patterns and physical activity levels typically change as countries increase in affluence and as their populations urbanize – what is known as the nutrition transition. Medical innovation in disease treatment and improvements in infrastructure (e.g. the delivering of clean water and disposal of waste) are sufficient to offset the impact of less-than-ideal diets on life expectancy, up until a point. Well-being generated through a country's caloric affluence has a ceiling. Once the ceiling is reached, increases in per capita calorie consumption begin pulling down health indicators. As the epicentre of cheap calories, we are beginning to witness the effects of this in the US. While the overall life expectancy rate in the US is holding steady (for now), a new study shows that in hundreds of counties at least – most located in the South – life expectancy has fallen in recent years. These counties also have some of the highest obesity rates in the world, in addition to very high levels of (racial) inequality (Kulkarni, et al., 2011).

This helps explain the mixed relationship between life expectancy and economic growth. As detailed in Figure 1, life expectancy is strongly positively correlated to national affluence up to roughly USD 10 000 GDP per capita.[3] After this, the relationship flattens out considerably. And, as Figure 2 illustrates, beyond USD 20 000 GDP per capita the relationship washes out entirely. Perhaps this is due, at least in part, to the variability in dietary profiles among affluent nations, as some are consuming oils, fats, and sugars (as discussed shortly) at levels that could conceivably begin bringing down life expectancy rates.

The FHSI also includes a subjective well-being indicator – specifically, average reported levels of life satisfaction for each country (on a scale from 0 to 100). Clearly, life satisfaction is not going to be high when people are starving. But equally, while conventional economic theory assumes increased consumption (including consumption of food) is forever positively correlated with welfare, too much of a good thing is actually bad from a life-satisfaction standpoint.

A growing body of research indicates that after a certain point more choice is associated with decreased welfare, as measured by an increased risk of depression, stress, regret, and, when it comes to food, unhealthy dietary habits (Mishan, 1967; Kasser, 2002; Schwartz, 2004; Schor, 2005; Jackson, 2009). One study examined 7,865 young female adults (18 to 23 years of age) at the time of the initial survey (Ball et al., 2004). The same women were surveyed again four years later. Even after controlling for aspects of life such as current occupation, young women who were overweight or obese were more dissatisfied with work/career/study, family relationships, partner relationships, and social activities. The authors conclude that 'being overweight/obese may have a lasting effect on young women's life satisfaction and their future life aspirations' (Ball et al., 2004, p. 1019). Other studies point to strong links between body mass index (BMI) and depression and anxiety, regardless of gender (Schibner et al., 2009). (BMI is calculated as weight [kg]/height [m]^2 and among adults there are four categories: underweight [less than 18.5], normal weight [18.5–24.9], overweight [25–29.9], and obese [greater than 30].) Moreover, a poor diet appears to be positively correlated with decreased life satisfaction, even after controlling for BMI.

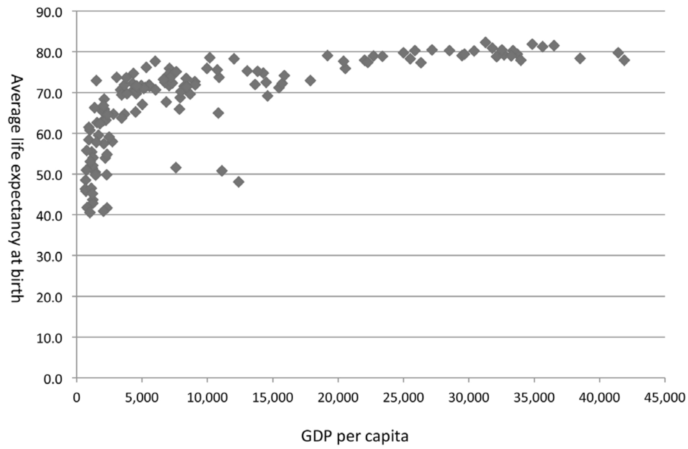

Figure 1. Relationship between life expectancy and GDP.

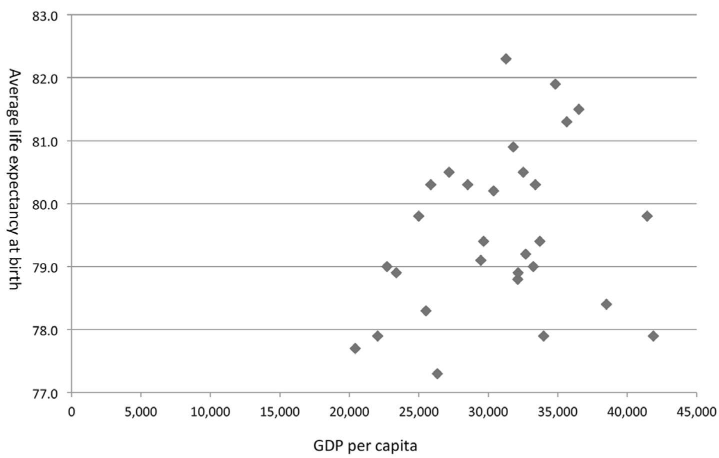

Figure 2. Relationship between life expectancy and countries with a GDP per capita of USD 20 000 and greater.

For instance, a strong positive association has been found between consumption of soft drinks and sugary food and risks for suicidal behaviours among adolescents in China (Pan et al., 2011). These findings have since been replicated in a study that looks at snack-food consumption more generally among Chinese adolescents (Wenga et al., 2012). It is with this research in mind that a third indicator of individual and societal well-being has been included in the FHSI – daily per capita consumption of oils, fats and sugars – which is discussed later when addressing issues related to nutritional well-being. As the above literature makes clear, excessive consumption of oils, fats and sugars negatively affects human welfare.

As with life expectancy, the relationship between life satisfaction and economic growth is varied, especially among countries with a GDP per capita greater than USD 10 000 (see Figure 3). One particularly striking aspect of Figure 3 is how some countries are able to produce high levels of life satisfaction among their citizens with

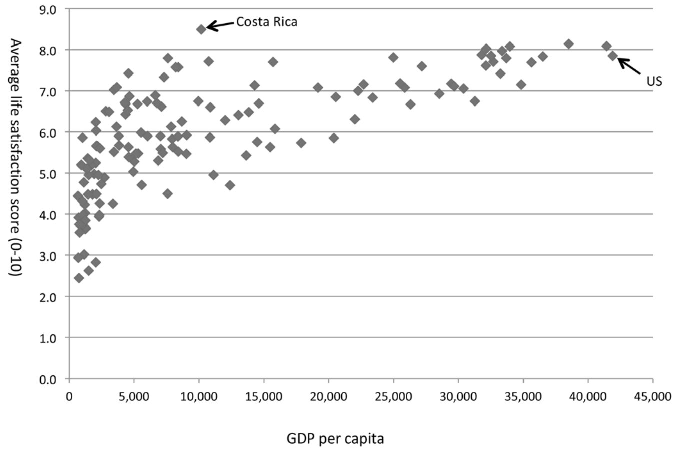

Figure 3. Relationship between life satisfaction and GDP per capita.

a fraction of the wealth found in other countries. For example, the average Costa Rican reports being considerably more satisfied than the average citizen of the US even though the former has *one fourth* of the latter's wealth. This point will be revisited in the Conclusion, when we learn about the mixed relationship that FHSI scores have with GDP per capita.

Sustainability

While the sociology of food and agriculture literature is rife with examples linking food-related practices and policies to ecological impacts, conventional understandings of food security are remarkably silent on the subject of sustainability. To be fair, scholars and practitioners have acknowledged the value of 'natural capital' and 'natural resource assets' when discussing such phenomena as regional or community food security (Bennett, 2001; Flora, 2010). Yet, when food security is measured and defined by international organizations like the FAO, ecological sustainability is given very little (if any) weight. From a long-term food security perspective, however, large ecological footprints are fundamentally unsustainable and therefore ought to be avoided. Even in the shorter term, an excessive ecological footprint for a country can suggest (among many other things) dietary patterns that can have a negative impact of both life expectancy and life satisfaction (which ties back to earlier-discussed indicators). We know, for example, that diets consisting of large amounts of highly processed foods come at tremendous cost to the environment in that 'value added' processing consumes significant amounts of energy, water, and other natural resources (Carolan, 2011). The same holds for diets high in animal fats/protein. The greater the per capita consumption of animal flesh (especially beef) the greater the diet's ecological footprint (D'Silva and Webster, 2010). It seems impossible to define a nation as 'food secure' when its food comes at great expense to the ecological productive base that makes agriculture possible.

The FHSI therefore includes two sustainability indicators. The one addressed in this subsection is that of total per capita water food-print as a percentage of total per capita renewable fresh water. The second indicator – daily per capita consumption of oils, fats and sugars – will be elaborated upon shortly. The first ecological indicator looks at countries' total per capita water food-print as a percentage of their total per capita renewable fresh-water supplies (see Table 1).[4] It is calculated by taking a country's total virtual water food-print per capita and dividing it by the country's renewable fresh-water resources per capita. The former is the sum total of a country's 'green', 'blue', and 'grey' water footprints for domestic- and internationally sourced food. The green water food-print refers to the use of green water resources (such as rainwater that does not become run-off) that go towards the growing of crops. The blue water food-print denotes the utilization of water resources – surface and groundwater – along the supply chain of a product. And the grey water food-print represents the volume of fresh water required to assimilate and adequately dilute the load of pollutants that resulted from the production and processing of commodities (Hoekstra et al., 2011).

As indicated in Table 1, this calculation brings to light a remarkable variability between countries in terms of the sustainability of their respective water food-prints. For instance, Egypt's total per capita water food-print is more than *53 times* greater than its total per capita renewable domestic fresh water (as measured in cubic meters). In other words, Egyptians are consuming food, on a per capita basis, at a rate 53.7 times greater than what the country's fresh-water stores could provide were all its food grown domestically. The United Arab Emirates – to take another grossly unsustainable water food-print – has a total per capita water foodprint that is 49.5 times greater than what its domestic fresh-water sources could sustain. Compare this to Iceland. Their total water per capita foodprint is a mere 0.31% of their total per capita renewable fresh-water reserves. Or take, for another example, the US. While the US consumes more calories per capita than any other country, its total per capita water food-print as a percentage of total per capita renewable fresh water is roughly 28.8%. With this indicator, the US benefits considerably from the geophysical fact that it is water-rich, especially relative to countries in the Middle East who are water-poor. The US case is a good example for why two ecological indicators are included in the FHSI. According to this water food-print indicator, the US is operating well within its ecological limits. The unsustainability of the US food system is picked up, and the country is penalized accordingly, with the second ecological indicator, where daily per capita consumption of oils, fats and sugars are factored into the equation.

In an attempt to standardize the data the afore-mentioned water food-print percentages were ascribed a value. The rationale for this was twofold. First, if this was not done, countries such as Egypt would be unduly punished for their dependency on virtual water. It was also desirable to keep the values of each indicator close to a scale of zero to 100; otherwise there was the very real risk that one indicator would have disproportional influence in the final calculation of the FHSI. Countries with a percentage greater than 500 were given a score of a *negative* 25 (Egypt, for example, with a total water food-print 5,372% greater than its renewable fresh-water footprint, received such a score). These countries clearly need to be penalized, as it is inconceivable to label any country 'food secure' that consumes water via food at a rate that is at least five times greater than what its domestic renewable fresh-water sources would allow. Countries with a percentage between 201 and 500 were given a score of zero. Those with a percentage between 101 and 200 were given a score of 25. While possessing a total water food-print per capita greater than what their own renewable fresh-water capacity would allow, countries scoring 25 are at least close to consuming within their domestic water budget. Those countries with a percent-

Table 1. Total per capita water food-print as a percentage of total per capita renewable fresh water (top 20 bold).

Iceland	**0.310925**	Latvia	20.17891	Poland	87.11717
Guyana	**0.463958**	Austria	20.28971	Rwanda	88.35623
Suriname	**0.737291**	Vietnam	20.65173	Uganda	88.80038
Solomon Islands	**0.840152**	Argentina	21.24511	Mauritius	90.00616
Gabon	**1.255006**	Tajikistan	22.88096	Ukraine	92.79638
Congo, Rep.	**1.375145**	Switzerland	23.79939	Ghana	93.25655
Norway	**1.492844**	Philippines	24.21844	Benin	93.72615
New Zealand	**1.803913**	Mozambique	25.39705	Spain	95.20944
Peru	**1.832024**	Korea, Dem. Rep.	26.14901	Germany	96.39995
Chile	**2.055273**	Mongolia	28.80105	Iran, Islamic Rep.	99.8952
Canada	**2.235956**	United States	28.81734	Bangladesh	103.1803
Liberia	**2.27056**	Lithuania	29.23539	Chad	106.1975
Nicaragua	**2.592148**	Cote d'Ivoire	32.08335	Luxembourg	109.394
Colombia	**2.645574**	El Salvador	32.69854	Korea, Rep.	112.0642
Panama	**2.833502**	Japan	34.8435	Azerbaijan	113.8419
Belize	**3.328909**	Belarus	39.91698	Zimbabwe	116.409
Cen. African Rep	**3.635219**	Thailand	40.42675	Czech Republic	118.3407
Congo, Dem. Rep.	**3.908633**	Greece	41.2503	Belgium	127.3754
Costa Rica	**4.927414**	Macedonia, FYR	43.11556	South Africa	129.592
Fiji	**5.123461**	Cuba	44.89565	Denmark	131.2958
Sierra Leone	5.128947	Jamaica	45.78536	Botswana	163.9749
Russian Fed.	5.560977	Kazakhstan	46.07092	Lebanon	172.806
Myanmar	5.713543	China	46.62717	Morocco	183.7063
Finland	5.808745	UK	46.99359	Netherlands	189.1231
Ecuador	5.848269	Sri Lanka	47.76881	Uzbekistan	190.5102
Venezuela, RB	6.027668	Turkey	47.77913	Cape Verde	201.1132
Sweden	6.687868	Gambia, The	49.13131	Kenya	206.0383
Guinea	6.862971	Mali	49.223	Burkina Faso	216.345
Brazil	6.870289	Togo	49.79357	Antigua & Barbuda	233.4755
Cameroon	8.624576	Mexico	49.86648	Sudan	240.704
Honduras	8.959642	France	50.07557	Cyprus	298.3301
Madagascar	9.161266	Slovak Republic	50.66794	Hungary	364.6023
Australia	9.495994	Tanzania	52.25686	Pakistan	400.113
Malaysia	9.639907	Trinidad & Tobago	52.4241	Moldova	419.4376
Ireland	10.3169	Armenia	53.09702	Algeria	479.5854
Guinea-Bissau	10.89139	Senegal	53.16254	Tunisia	539.1999
Bolivia	11.07427	Burundi	57.50254	Syrian Arab Rep.	562.3369
Angola	11.91668	Dominican Rep.	59.13716	Barbados	596.4603
Guatemala	12.20631	Namibia	59.37643	Turkmenistan	792.6663
Cambodia	12.41807	Swaziland	60.22679	Yemen, Rep.	980.3836
Bosnia–Herzegovina	12.65526	Portugal	65.89199	Maldives	1348.921
Indonesia	12.78043	Lesotho	66.61771	Jordan	1380.964
Paraguay	12.92753	Italy	67.87557	Niger	1501.354
Uruguay	13.5924	Bulgaria	72.467	Malta	1635.169
Zambia	14.0694	Romania	75.14416	Saudi Arabia	1907.92
Georgia	15.09562	Ethiopia	77.24832	Libya	1985.424
Brunei Darussalam	15.29747	Haiti	77.43776	Mauritania	2104.172
Albania	15.87013	Comoros	78.40977	Israel	2162.802
Estonia	16.51885	India	81.01259	Bahamas, The	3089.918
Nepal	17.57755	Malawi	82.15477	United Arab Emir.	4949.472
Croatia	18.44257	Nigeria	85.739	Egypt, Arab Rep.	5372.204
Slovenia	18.68922				

age between 76 and 100 were given a score of 50; between 51 and 75, a score of 75; and between 26 and 50, a score of 100. Finally, those counties with a per capita water food-print of 25% or less were given a score of 125 (to not only reward but also to provide some symmetry to this measure as the low-end extends to negative 25).

Food Dependence

Trade dependency is also a variable worth discussing when thinking about genuine food security. For a variety of reasons that were discussed earlier, less affluent countries have been coerced into abandoning food independence for food dependence. Take the case of the Philippines. As Walden Bello (2008) notes, dictator Ferdinand Marcos had, remarkably, a better track record than either the World Bank or the International Monetary Fund (IMF) when it came to supporting policies that sought to improve the domestic food production capacity of the country. As Walden Bello (2008, p. 451) noted:

> 'To head off peasant discontent, the regime provided farmers with subsidized fertilizer and seeds, launched credit schemes, and built rural infrastructure. During the 14 years of the dictatorship, it was only during one year, 1973, that rice had to be imported owing to widespread damage wrought by typhoons. When Marcos fled the country in 1986, there were reported to be 900 000 metric tons of rice in government warehouses. Paradoxically, the next few years under the new democratic dispensation saw the gutting of government investment capacity. As in Mexico, the World Bank and IMF, working on behalf of international creditors, pressured the Corazon Aquino administration to make repayment of the $26 billion foreign debt a priority.'

The Washington Consensus, as it has come to be known, involves coercing less-affluent nations into abandoning the practice of surplus storage and any and all government support programmes directed specifically at small-holders (like those that provide often essential subsidies for fertilizer, seed and credit). If a country suffered crop failures, it was believed, they could always import whatever food they needed. The recent volatility in agricultural commodity markets has proved the folly of that assumption. Unfortunately, it was a lesson learned at the expense of the world's poor, as evidenced in 2009 when the world's hungry exceeded one billion.

Food dependence is a difficult concept to measure. There are data on agricultural trade calculated in terms of dollars and volume. Yet, the commodities included in these figures refer not only to food-stuffs but also agricultural commodities for industrial purposes and for bio-fuels. Moreover, the units of 'dollars' and 'volume' are problematic: as for the former, exchange value is not the same as use value; while in terms of the latter, 'volume traded' does not necessarily equal 'food volume' (e.g. although live animals are exported, the entire carcass is not consumed). It is also very difficult to discern, when looking at import/export data, between a country that is food independent and a country that is simply starving (e.g. both import very little food). The FAO does keep data on what they call the 'import dependency ratio' (IDR) of countries: IDR=imports/(production+imports–exports)×100. Yet this figure, too, is problematic. For instance, how the units (e.g. imports, production, and exports) are measured – volume or units of dollars – changes the outcome of the ratio. It is also clear that imported agricultural commodities are not always destined for domestic markets but may be re-exported to another country. This strategy is often used to work around trade sanctions and avoid certain trade barriers (for example, Firm X sends grain to India meant ultimately for re-exportation to Iran, as the country that Firm X resides within has a trade embargo with the Iranian government). Moreover, in light of the earlier discussion about FDI, we know that national dietary patterns can be shaped drastically through channels of foreign investment.

Yet these non-domestic fiscal food influences are missed by gross trade indicators. Fortunately, the FHSI is already employing an indicator that can double as a proxy for measuring food dependency: total per capita water food-print as a percentage of total per capita renewable fresh water. The value of this measure is its focus on *food consumed* (and the virtual water used through its life cycle), as opposed to, say, commodities imported, as many agricultural commodities never end up as (human) food.

Nutritional Well-being

We still need to distinguish between those countries that are not consuming enough, those that are consuming too much, and those that are consuming within parameters that are recommend by public health professionals. This brings us to the third indicator included in the FHSI: daily per capita consumption of oils, fats and sugars (as recorded and reported by the WHO).

Complete international data sets are hard to come by when looking for indicators of under- and over-nutrition. There are, as noted earlier, a number of indicators available that point to the *severe* under-consumption of food, like the prevalence of underweight children under the age of five and proportion of population below minimal level of dietary energy consumption. These statistics essentially break the world down into two categories: those nations who have absolutely nothing and those who have at least something – not a terribly useful distinction when trying to rank countries. Likewise, statistics are available which compare average BMI across countries. Yet, those data sets are woefully incomplete as not all countries compile these data. I am also well aware of the criticisms leveled at the BMI and of the tendency to place too much emphasis on it as proxy for individual health and well-being (see Guthman, 2011). What is required is a complete data set that provides an indicator of both under- and over-consumption; one that would not only highlight countries at both extremes but allow for distinctions to be made between countries that fall between these two ends. I ultimately settled on WHO data on the daily average per capita consumption of oils, fats and sugars.

The consumption of oils, fats and sugars are necessary for health up to a point, after which they begin to impact negatively upon health and well-being (Medez and Popkin, 2004). The Oxford University's British Heart Foundation Health Promotion Research Group recently published a report noting the deleterious effects of a high fat (specifically animal fat) diet. The study looked into the health implications of three diet scenarios: 'current diet trends', 'less meat' and 'fair less meat' (Friends of the Earth, 2010). 'Current diet trends' assume a diet where the level of meat and dairy consumed in UK remain the same – roughly 177.7 grams (6oz) of meat and 332.2 grams (11oz) of milk daily. The 'less meat' scenario would involve consuming 70 grams (2.5oz) of meat and 142 grams (5oz) of milk daily and more fruits and vegetables. Finally, the 'fair less meat' scenario assumes a *fair* distribution of animal protein across the UK of 31 grams (1.1oz) of meat and 57 grams (2oz) of milk daily and more fruits and vegetables. A 'less meat' diet was calculated to reduce UK government expenditures by GBP 0.85 billion annually: GBP 0.57 billion saved from a reduction in heart disease; GBP 0.07 billion from reduced stroke incidents; and GBP 0.20 billion from reduced cancer rates. More dramatic still, a 'fair less meat' diet was found to save British taxpayers GBP 1.20 billion annually: GBP 0.80 billion, GBP 0.10 billion and GBP 0.30 billion from reduced heart disease, strokes and cancer, respectively. As this study makes clear, a diet high in animal fat – and indeed the same applies to high fat diets in general – comes at considerable expense to taxpayers (who shoulder the health-care expenses) as well as to the unhealthy individuals (who no doubt experience decreased well-being from being sick) (see also Weber and Matthews, 2008). In sum, there are sufficient reasons for penalizing a country if the average diet of its citizenry is too calorically rich. We might even have grounds for calling that nation food insecure.

Bad diets, to put it plainly, are also bad for the environment. As mentioned previously, this indicator, therefore, also serves as a proxy measure of ecological sustainability. Take the case of the US. A report by the USDA offers some insight into the amount of energy that goes into producing, processing, and transporting food in the US. The final tally is over 17 000 calories (as a unit of energy) on a per capita daily basis. Figure 4 breaks those energy units down according to specific food categories (Canning et al., 2010). Over half of those calories go toward the making of highly processed foods; a third into the making of animal products such as meat, eggs and milk; and a sixth into grains, fruits and vegetables. Eating well is less energy intensive than eating poorly (Bomford, 2011). Thus, countries whose citizens eat poorly ought to be penalized for it – not just for reasons of public health and individual well-being but also because diets high in oils, fats and sugars come with a sizeable environmental cost.

Figure 5 details the relationship between daily per capita consumption of oils, fats and sugars and the percentage of disposable income that is spent on food for countries with a GDP per capita greater than USD 15 000. The relationship is negative (its correlation coefficient is –0.435). While inexpensive food is a laudable goal of any food system we know from other analyses that there is a point when food becomes *too* cheap; a point when the externalized costs far exceed benefits (e.g., see Carolan, 2011). Figure 5 supports this literature, while further suggesting that it is only certain types of calories that get less expensive – namely, high fat, empty ones – and that these price reductions are not universality experienced across food types.

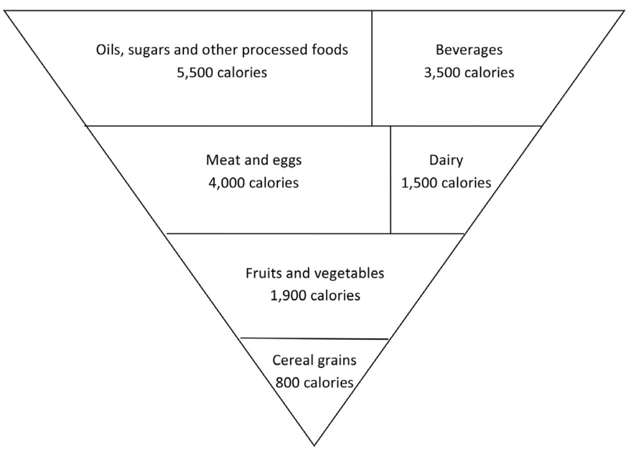

Figure 4. Break-down of the amount of energy (17 000+ calories per day per capita) consumed by the US food system.
Source: Based on Canning et al., 2010); Bomford, 2011; Carolan, 2012.

Prior to standardizing these data, which ultimately would allow cross-comparisons between countries, a couple assumptions had to be made. It was first necessary to establish what could be considered an 'optimal' average daily caloric intake. Individual differences in metabolic mechanisms and levels of activity (e.g. sedentary vs. active/manual labour) make this exceedingly difficult and inherently problematic. On average, infants and children (below 10 years of age) require fewer calories than adults. Females on average require fewer calories than males. And as adults age their caloric requirements gradually lesson. After carefully considering all the various metabolic demands (see Table 2), it would be reasonable to settle upon 2,500 as an optimal daily per capita caloric intake.

Next, an optimal daily per capita caloric range for oils, fats and sugars had to be calculated. The WHO recommends that no less than 15% and no more than 30% of

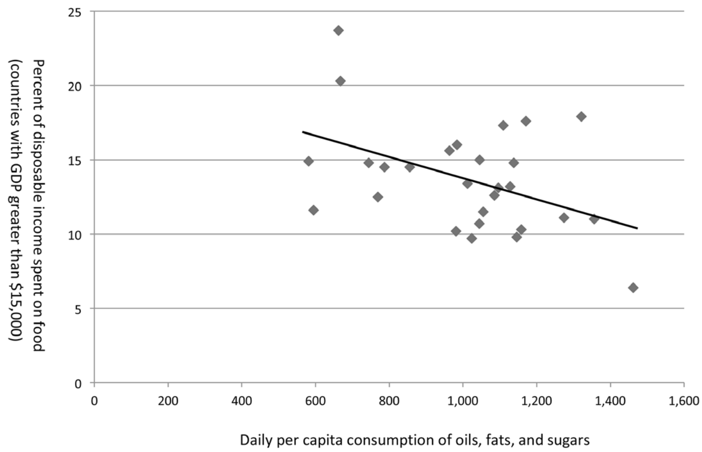

Figure 5. Relationship between daily per capita consumption of oils, fats, and sugars and percent of disposable income spent on food for countries with GDP per capita greater than USD 15 000.
Note: correlation coefficient = –0.435.

Table 2. USDA caloric intake guidelines.

Gender	Age (years)	Activity Level		
		Sedentary	Moderately active	Active
Child	2–3	1,000	1,000–1,400	1,000–1,400
Female	4–8	1,200	1,400–1,600	1,400–1,800
	9–13	1,600	1,600–2,000	1,800–2,200
	14–18	1,800	2,000	2,400
	19–30	2,000	2,000–2,200	2,400
	31–50	1,800	2,000	2,200
	51+	1,600	1,800	2,000–2,200
Male	4–8	1,400	1,400–1,600	1,600–2,000
	9–13	1,800	1,800–2,200	2,000–2,600
	14–18	2,200	2,400–2,800	2,800–3,200
	19–30	2,400	2,600–2,800	3,000
	31–50	2,200	2,400–2,600	2,800–3,000
	51+	2,000	2,200–2,400	2,400–2,800

Source: Adopted from USDA, 2005.

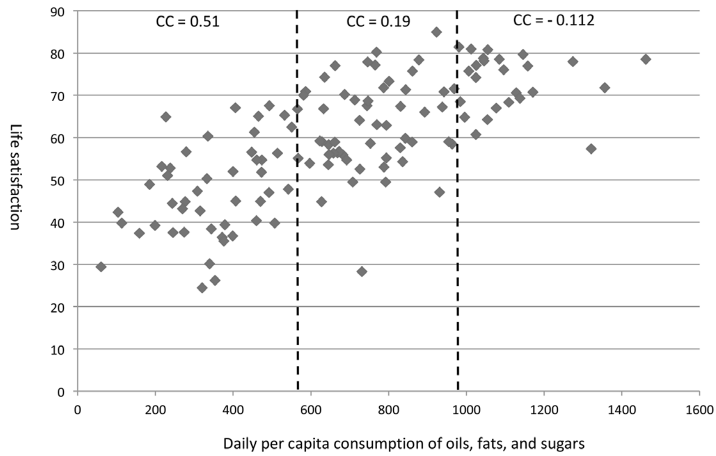

Figure 6. Relationship between daily per capita consumption of oils, fats, and sugars and life satisfaction.
Note: CC = correlation coefficient.

one's daily caloric intake come from fats. Based on a diet of 2,500 calories a day, that equates to no fewer than 375 calories and no more than 750 calories from fat. The WHO further recommends that no more than 10% of one's daily energy intake be derived from sugar. In other words, based on a daily diet of 2,500 calories, no more than 200 calories should come from sugars. Combining these figures we are left with an optimal oils, fats, and sugars daily caloric range of between 575 (375+200) and 950 (750+200). Figure 6 examines the relationship between daily per capita consumption for oils, fats and sugars and average life satisfaction. While the relationship between these two variables is fairly significant until 575 calories (correlation coefficient of 0.51), it flattens out considerably between 575 and 950 calories (correlation coefficient of 0.19), eventually turning *negative* after 950 calories (correlation coefficient of –0.112).

A method then had to be devised to compare countries that do not fall with the optimal range, at both the high and low ends. Calculating the low end was less problematic, as zero calories from oils, fats and sugars is an obvious base. But what top-end caloric figure would be comparable to a figure of zero? It could be argued that 2,000 calories per day from oils, fats, and sugars is a suitable top-end total. Admittedly, it is ultimately a normative judgement to make an assessment of whether individual and societal welfare is comparable between societies that consume zero and 2,000 calories daily from oils, fats and sugars.

The last step involved standardizing the data on a 100-point scale. Those countries that fell within the optimal range of between 575 and 950 calories received a score of 100. Among those that fell below, a calculation was made based upon their location between the low end of the optimal range (575 calories) and the base (zero calories). Thus, for instance, if a country had a daily per capita caloric oil, fat and sugar intake of 287.5 it received a 50%, whereas if that caloric figure was, say, 517.5 they received a 90% (the closer to the optimal range the higher/better the score). For countries above the optimal range, the calculation was made in relation to their location between the high end of the optimal range (950 calories) and the top (2,000 calories). Thus, for instance, if a country had a daily per capita caloric oil, fat and

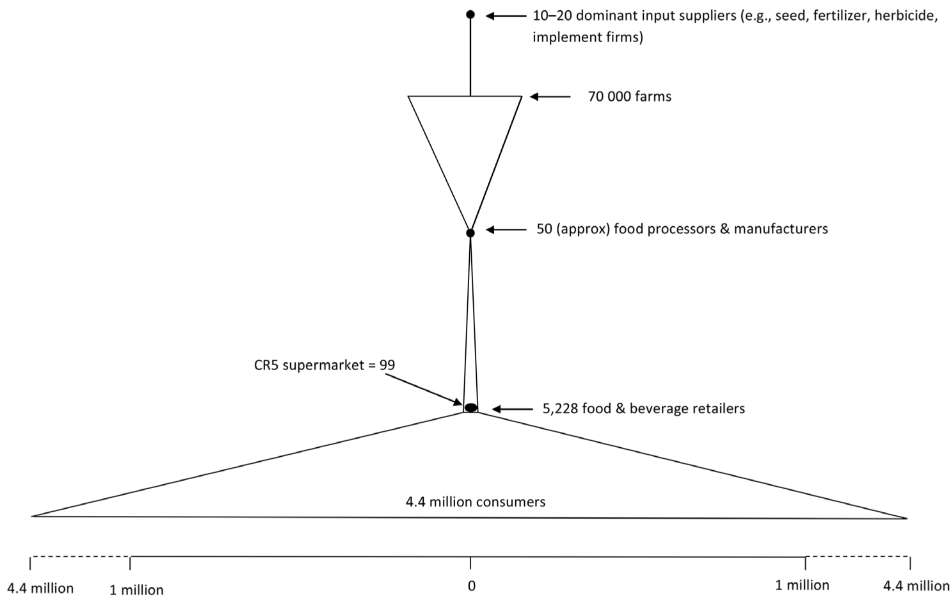

Figure 7. New Zealand food system 'hour-glass' (hanging by a thread).
Source: Compiled by author, with assistance from Paul Stock and Miranda Mirosa.

sugar intake of 1,475 it received a 50% (coincidently, the caloric intake for the US was 1,462, leaving it with percentage of 51.3), whereas if that caloric figure was 1,055 they received a 90% (again, the closer to the optimal range the higher/better the score).

Food System Concentration

The last index serves as a proxy for food-system concentration: supermarket concentration. More specific still, this index looks at the CR5 ratio (or five firm concentration ratio) for the retail food sector.[5] The CR5 reflects the sum of market shares of the top five firms for a given industry. A standard rule of thumb is that when the CR5 goes beyond 50%, that market can be taken to be highly concentrated. The 'hour-glass' metaphor is routinely evoked in the sociology of food and agriculture literature (Carolan, 2012). The hour-glass shape refers to the highly concentrated 'middle' that connects farms with consumers (Hendrickson et al., 2001). Wherever there is market concentration there is an increased risk of market distortion in the form of buyer and/or seller power, which can have a deleterious effect on food access and food security more generally (see Burch and Lawrence, 2007; Stringer and Le Heron, 2008; Smith et al., 2010). Agri-food market concentration is becoming increasingly pronounced, particularly among high-income countries. Take, for example, the case of New Zealand, as illustrated in Figure 7, which has one of the most concentrated supermarket sectors in the world (note also how I have extended the hour-glass metaphor by referring to it as *hanging by a thread* to refer to the highly concentrated input sector; Carolan, 2012).

Given the volume of their sales, large retail firms such as Walmart and Kroger, are dealing increasingly with a handful of very large packers, allowing them to by-pass the wholesale sector entirely. This not only cuts the 'middleman' out of the equation but allows retail firms to exploit the buyer power held by the largest processing firms, who then pass the tighter margins on to producers. This helps explain the growing gap between what producers are paid and retail prices for those products. A study from 2004 calculated that the difference between the price paid to farmers and that paid by consumers increased by 149% between 1970 and 1998 (Marsh and Brester, 2004). Retail concentration can also negatively affect individuals at the other 'end' of the chain: namely, consumers. Supermarket concentration, particularly at the city or regional levels, has been linked to food deserts (Blanchard and Matthews, 2008), higher food prices (Richards and Pofahl, 2010), and reduced food choice (Hawkes, 2008).

Once food retail data were obtained it was necessary to establish what percentage of food sales are accounted for by supermarkets in each country. A number of countries in South America (Chile, for example) have significant levels of supermarket concentration (CR5 ratios of over 50). Yet if, say, only 50% of all food sales occur in a supermarket/retail context it would be somewhat misleading to treat that nation as identical to one where the figure is closer to 100%. CR5 ratios thus needed to be adjusted (standardized) in some instances to take into account these discrepancies. The goal was to arrive at a statistic that reflected a ratio of market concentration for each nation's *total* food sales (and not just its supermarket/retail sales). The top 10 countries (among the 126 analysed) with the highest CR5 supermarket ratio (as a factor of total food sales) are Australia (CR5=99), New Zealand (CR5=99), Finland (CR5=91), Norway (CR5=91), Sweden (CR5=91), Switzerland (CR5=85), Ireland (CR5=83), Slovenia (CR5=83), Denmark (CR5=82), and Iceland (CR5=81). The 'mirror' CR5 ratio was then added into FHSI to ensure this statistic was in line with previous indicators, as higher numbers are desirable (thus, for example, Australia and New Zealand each had a supermarket concentration score of 1 inserted into the Index).

Results and Discussion

FHSI scores were arrived at by adding the five afore-mentioned indicators and calculating their average. The results of this tabulation are contained in Table 3. The country topping the list is Costa Rica. Costa Rica has a higher life expectancy than that found in the US (78.5 versus 77.9). It also has the highest reported life satisfaction score of any country (85 out of 100). Its total water per capita food-print is a mere 4.9% of their total per capita renewable fresh-water reserves. The daily per capita consumption of oils, fats and sugars in Costa Rica is at the high end of the optimal range: 923 calories. And, its food retail sector proves to have relatively low levels of supermarkets concentration: CR5=20.

The remainder of this article will discuss the implications of the FHSI and the scores found in Table 3. This discussion will centre upon three points. Those points elaborate on how the FHSI challenges older North–South divisions, how it places into question conventional approaches to 'food security', and how its subsequent ranking of countries supports the argument that you cannot eat GDP.

Challenging older North–South Divisions

In 1980, ex-German Chancellor Willy Brandt chaired a commission that produced a report entitled *North–South: A Programme for Survival*. The report presents a world

Table 3. Final FHSI ranking (top 20 bolded).

Costa Rica	**77.69941**	Philippines	66.18093	Morocco	50.3491
Iceland	**76.9785**	Thailand	65.58672	Cyprus	49.7586
Finland	**76.82639**	Slovakia	65.58326	Madagascar	49.677
Ireland	**76.38799**	Belarus	65.40359	Togo	49.08168
Norway	**75.96306**	Turkey	65.32289	Congo, Dem. Rep.	48.92
Panama	**75.60614**	Sri Lanka	65.09939	Lebanon	48.71698
Australia	**75.23405**	Dominican Republic	64.45163	Haiti	48.712
New Zealand	**74.78275**	Cuba	64.02	Namibia	48.476
Slovenia	**74.48956**	Venezuela	63.419	Bangladesh	48.12083
Sweden	**74.24623**	China	62.02574	Nigeria	47.70454
Argentina	**74.23092**	Portugal	62.00208	Mali	47.67466
Colombia	**74.12041**	Guinea	61.554	Chad	45.79439
Guatemala	**73.8**	United States	61.54381	Algeria	45.51621
Nicaragua	**73.56197**	Italy	61.34197	South Africa	45.06294
Brazil	**73.4256**	Kazakhstan	61.26534	United Arab Emir.	45.02
Canada	**73.27342**	Romania	61.22323	Malta	44.98807
Chile	**73.23772**	Vietnam	60.619	Pakistan	44.12322
Paraguay	**72.99126**	Bulgaria	60.4792	Egypt	42.14337
Malaysia	**72.93622**	Trinidad & Tobago	59.82946	Uzbekistan	42.08304
Honduras	**72.92498**	Spain	58.5241	Ghana	42.00219
Croatia	72.8803	Central African Rep.	57.8	Tunisia	41.48529
Switzerland	72.68762	Poland	57.13814	Syria	41.44615
Bosnia–Herzegovina	71.70576	Tajikistan	56.50004	Jordan	41.35508
Lithuania	71.02415	Senegal	56.42497	Tanzania	41.22243
Peru	70.93786	Cameroon	56.01828	Botswana	41.13291
Uruguay	70.82868	Nepal	55.67337	Israel	41.01647
Ecuador	70.8148	Saudi Arabia	54.82	Hungary	40.7091
Mexico	70.55152	Netherlands	54.83722	Moldova	40.56666
Estonia	70.51097	Denmark	54.73759	Benin	38.90501
Austria	70.318	Mongolia	54.20514	Zimbabwe	38.83415
Indonesia	70.27923	Ukraine	54.14168	Uganda	38.53404
Latvia	70.26255	Sierra Leone	53.54083	Mauritania	37.54381
Japan	69.9647	India	53.48482	Azerbaijan	37.25394
Russia	69.73279	Czech Republic	53.24123	Sudan	36.806
Guyana	69.7025	Mozambique	53.20794	Malawi	36.592
United Kingdom	69.23483	Korea	53.19107	Burundi	32.66943
Jamaica	67.88	Iran	53.18516	Ethiopia	32.24761
Albania	67.66962	Angola	52.82819	Kenya	31.64347
El Salvador	67.62095	Cambodia	52.81402	Yemen	31.612
Bolivia	67.12047	Germany	52.45637	Rwanda	31.11954
France	66.77313	Zambia	51.11917	Burkina Faso	30.49701
Greece	66.43562	Armenia	50.94918	Niger	22.18942

with a clear dividing line between the rich, influential North and a poor, marginalized South that requires continual international assistance if it is to 'develop'. While the world is drastically different today when compared to 1980 the image of the Global South, as it is called, remains much the same (Williams et al., 2009). This is especially the case when talking about food security (see, for example, Milkias, 2010).

Yet, scholars of peasant/agro-ecology agriculture (such as Altieri, 2004) and international peasant movements like La Via Campesina (such as McMichael, 2006) know that a country's location in the South does not automatically destine it to the category of 'food insecure'. Likewise, scholars have been arguing with increasing intensity that high-income nations should not be assumed to be food secure merely on the basis of their being awash in cheap, fatty, sugary calories (see Carolan, 2011;

Guthman, 2011). The FHSI lends empirical support to each of these positions. It challenges old developmental battle lines between the 'leaders' of the North and the 'followers' (hoping to emulate the North) located in the South.

Questioning Conventional Approaches to 'Food Security'

The FHSI makes problematic the conventional calorie-ization understanding of food security. Calories, as already established, while important up until a point, do not have an endless positive correlation with individual and societal welfare. After a certain level of consumption more is not better. 'More' can actually push a country *back into* a state of food insecurity. Excessive caloric consumption is associated with poor health and an increase in health-care expenses. A poor diet is a risk factor for four of the six leading causes of deaths in the US: heart disease, cancer, stroke and diabetes. When combined with obesity, these diseases have been estimated to cost USD 556 billion per year (Wallinga et al., 2009). Health-care costs attributed to obesity extract roughly GBP 10 billion annually from British taxpayers, while the wider costs to society and business are estimated to be close to GBP 49.9 billion per year (Butland et al., 2007, p. 5). For Canada, a 2011 report places the total economic cost of overweight and obese individuals at approximately CAD 300 billion a year: CAD 127 billion in health care; CAD 72 billion in lost productivity due to total disability; CAD 49 billion in lost worker productivity due to higher rates of death; and CAD 43 billion in lost worker productivity due to the disability of active workers (Preidt, 2011). Fifty years ago, Americans spent over 17% of their income on food, while roughly 5% of national income was spent on health care. Today, those numbers are almost precisely the opposite. The average citizens of the US now spends less than 10% of their income on food, while the cost of their health-care tops 16% of national income. Similar trends have also been recorded for European Union (EU) countries (Carolan, 2011).

And *how* we go about producing all those cheap, empty calories cannot be sustained in the long run – a reality that further undermines the food security of many countries. In the US, avoidable annual food waste amounts to over 55 million metric tons – or nearly 29% of annual production – which if consumed could save at least 113 million metric tons of CO_2 equivalents from being emitted, annually (Stuart, 2009). The annual total cost of pesticides alone in the US, upon public health, the environment, and human communities, has been placed in the billions of dollars (Pimentel, 2005). Soil erosion, water pollution, climate change, and so forth are crucial to any discussion of both sustainability and food security.

What Can You Eat If Not GDP?

A wealth of peer-reviewed research has been published recently documenting empirically how after a certain point economic growth becomes unconnected – if not negatively related – to individual and societal indicators of well-being (see Jackson, 2009; Knight and Rosa, 2011; Dietz et al., 2012). Economist Herman Daly (1999) calls this 'uneconomic growth': growth that costs us more than the benefits we accrue from it. We can add the FHSI to this list of literature. Figure 8 plots the relationship between FHSI and GDP per capita. Taking all 126 countries collectively reveals a moderate positive relationship between FHSI and GDP per capita (a correlation coefficient of 0.359). Yet, something very interesting becomes apparent when we ex-

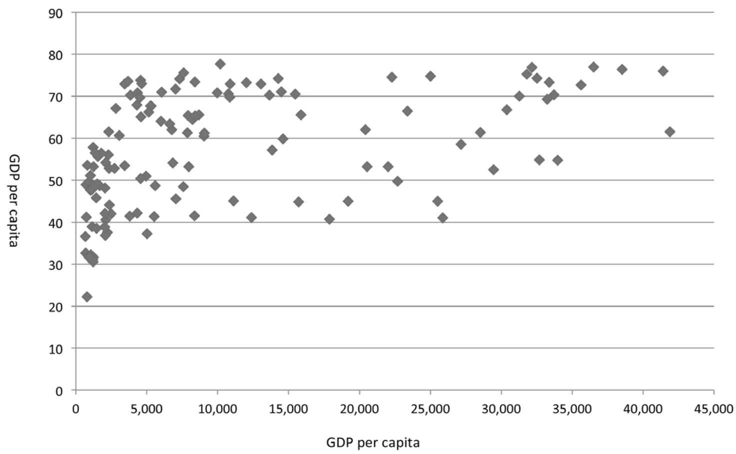

Figure 8. Relationship between FHSI and GDP per capita.

amine countries going from lowest GDP per capita to highest. Looking at countries with a GDP per capita of USD 10 000 or greater, the relationship begins to noticeably flatten out (a correlation coefficient of 0.164). Among countries with a GDP per capita of USD 30 000 or greater, the relationship is non-existent (a correlation coefficient 0.078). It is among countries with a GDP per capita of USD 35 000 or greater that the relationship becomes *negative*, in a significant way (a correlation coefficient –0.505).

So what can be eaten, if not GDP per capita? A growing body of research has examined how inequality negatively affects a society's ability to efficiently improve the welfare of its citizenry. Take some of the findings from Wilkinson's and Pickett's (2009) highly acclaimed *The Spirit Level*. According to these authors, more equal societies have fewer health and social problems, treat children better, treat women more equally, have a greater sense of collective responsibility, have lower levels of mental illnesses, and their business leaders are more likely to agree that their governments should co-operate with international environmental agreements (see also Wilkinson et al., 2010).

In light of this research FHSI scores were plotted against national levels of inequality (as measured by the genie coefficient). When all 126 countries were viewed collectively, a very weak negative relationship was found between the variables (correlation coefficient of –0.071). As lower-income countries were removed, however, the strength of that negative relationship grew significantly. Among countries with a GDP per capita of USD 20 000 or greater, the correlation coefficient was –0.285. Among countries with a GDP per capita of USD 25 000 or greater, the correlation coefficient was –0.426. Finally, among the highest income countries – namely, those with a GDP per capita of USD 35 000 or greater – the correlation coefficient was a remarkably robust *negative* 0.97. Inequality, it seems, has an eroding effect on a country's ability to have its population be (and feel) food secure.

As the FHSI is compiled using macro-level indicators it is difficult to understand fully its inverse relationship to inequality. Looking to the literature we know that more equal societies are, among other things, happier and have higher life expectancies than less equal societies (Wilkinson and Pickett, 2009). No doubt the FHSI is reflecting this. It is also known, from the agri-food literature, that inequality is detrimental to dietary health, fruit and vegetable consumption, and food security more generally (Rose and Richards, 2004; Drewnowski and Darmon, 2005; Morton et al., 2005). Due to food policy and the structure of the food system in affluent nations there tends to be an inverse relationship between energy density (MJ/kg) and energy cost ($/MJ) (Carolan, 2011). In other words, energy-dense (nutrient-shallow) foods represent the lowest-cost option for many consumers in high-income counties. This offers a piece to the puzzle as to why the highest rates of obesity in affluent counties occur among population groups with the highest poverty rates and the least education (Drewnowski and Specter, 2004).

Conclusion

The FHSI up-ends conventional thinking as it pertains not only to food security but also to growth and prosperity. While space does not allow for such analyses here, an obvious next step would involve taking the ranking of the FHSI and conducting case-studies of some of the countries to assess the 'fit' of the index and to learn why some fared as they did. It would also be productive for future research to gain a better understanding of why inequality seems to impact FHSI indicators as it does, particularly among high-income countries.

Regardless of whether you actually think Costa Rica is more food secure than, say, Canada, Mexico, New Zealand, Sweden or the US, the FHSI is based on 'objective' indicators that cannot be summarily dismissed out of hand. Based on these indicators Costa Rica has accomplished something that is quite impressive, as have many other countries that have high FHSI scores. Gleaning lessons from those countries with high FHSI scores, as well as perhaps some suggestions on what to avoid (especially among countries with low FHSI scores and high GDP per capita), could prove fruitful as the issue of food security continues to grow in both its salience and importance.

Finally, a few words about the term 'food security', which I evoke with some hesitation. With scholars such as Wittman et al. (2010), I am highly critical of the direction in which we have been led in its name. Yet if we can keep in mind the term's roots, which extend at least as far back as to Roosevelt's 1941 State of the Union Address, the term itself is not the problem. The problem, rather, has been in its application. By employing the term, I am looking to recapture that original spirit of food security that has since been lost; a spirit, I might add, that also haunts certain movements that are presently critical of policies promoted in its name. In their position statement, *Food Sovereignty: A Future without Hunger*, La Via Campesina states that: 'Food sovereignty is the right of each nation to maintain and develop its own capacity to produce its basic foods respecting cultural and productive diversity. We have the right to produce our own food in our own territory. Food sovereignty is a precondition to *genuine food security*' (La Via Campesina, 1996, p. 1; my emphasis).

If genuine food security is premised on the enhancement of individual and societal well-being, ecological sustainability, food independence, nutritional well-being, and truly competitive (and socially and morally embedded) markets, then the FHSI may prove a useful tool for imagining and enacting new lines of thought around the concept. One of the strengths of the FHSI is that it embraces the very concerns that at present cause so many to be critical of 'food security' as currently understood. The FHSI does not provide any solutions to problems that ail us. But it is a reminder of issues that ought to be included in discussions about genuine food security and of the limitations of current practices and policies said to be directed towards that end.

Notes

1. Space constraints require that this section be kept short. A much longer history is being developed in a book manuscript tentatively entitled *Reclaiming Food Security*.
2. Data obtained from <http://www.happyplanetindex.org/public-data/files/hpi-2-0-results.xls>.
3. GDP per capita data obtained from <http://www.happyplanetindex.org/public-data/files/hpi-2-0-results.xls
4. Data come from <http://data.worldbank.org/indicator/ER.H2O.INTR.PC> and Mekonnen and Hoekstra, 2011 (<http://www.waterfootprint.org/?page=files/WaterStat-NationalWaterFootprints>).
5. Data obtained from Planet Retail, <http://www1.planetretail.net/>.

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