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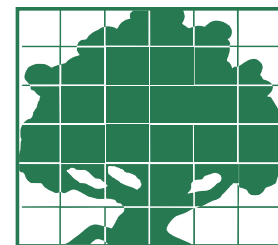
Authors

Zilberman, David
Carman, Hoy
Green, Richard
et al.

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Beer: A Poster Child of the Bioeconomy

David Zilberman

The bioeconomy includes agricultural sectors that rely on farm inputs and biological processes to produce a wide array of products. The traditional bioeconomy relied on fermentation to produce cheese, beer, etc., while the modern bioeconomy relies on biotechnology. The history of beer used as a case study suggests that over time, the bioeconomy evolved to produce differentiated products with elaborate supply chains. Its evolution depended on investments in research and a balanced regulatory environment.

The bioeconomy has been promoted in recent years. It is viewed as a large sector of the economy that relies on biological processes to produce various end products, including food, fuel, chemicals, etc.

The recent interest in the bioeconomy stems first from concerns about climate change and the need to move away from nonrenewable resources. It also stems from the new capability developed in recent years through modern techniques in molecular biology. While the bioeconomy seems to be a modern concept, this paper argues that it has been with us for millennia and was part of our oldest industries.

We use beer as a case study, beginning with its origin in the traditional bioeconomy and drawing out what lessons it holds for the new bioeconomy. The first section elaborates on the bioeconomy, the second tells the story of beer, and the third provides some of its implications. This history of beer suggests that technological development will lead to the expansion of the bioeconomy, which will lead to new types of farming and new differentiated products. The development of the bioeconomy will also be dependent on the ability to capture new opportunities and introduce reasonable regulations that balance concern over safety, with opportunities for creativity and innovation.

The Bioeconomy and Supply Chain

The bioeconomy includes many sectors such as food, agriculture and

forestry, fisheries and aquaculture, biotechnology, biofuels, and fine chemicals. The bioeconomy is part of the renewable economy (which also includes solar energy and the recycling sector) that will allow humanity to deal with the increasing monetary and environmental cost of nonrenewables and climate change.

Agriculture is a crucial element of the bioeconomy as the source of its raw materials. The notion of the bioeconomy suggests that outputs of agriculture will contribute to a larger range of products consumed. This new range of products provides new opportunities for agricultural production; and the growing importance of these products affects the way that we understand the economics of agriculture.

Understanding the performance of the bioeconomy is a new challenge for agricultural economists. One key element in this challenge is understanding the supply chain of each of its sectors. These supply chains consist of at least two elements: the production of feedstocks and their processing to a final product. For example, the biofuel sector is an important element of the bioeconomy. In the case of biofuels, the supply chain includes the production of feedstocks on farms (e.g., corn and sugar cane) and processing to produce multiple by-products in refineries (e.g., ethanol and dried distilled grains). The modern bioeconomy also includes companies that produce enzymes, farms that produce feedstock for medical products,

Also in this issue

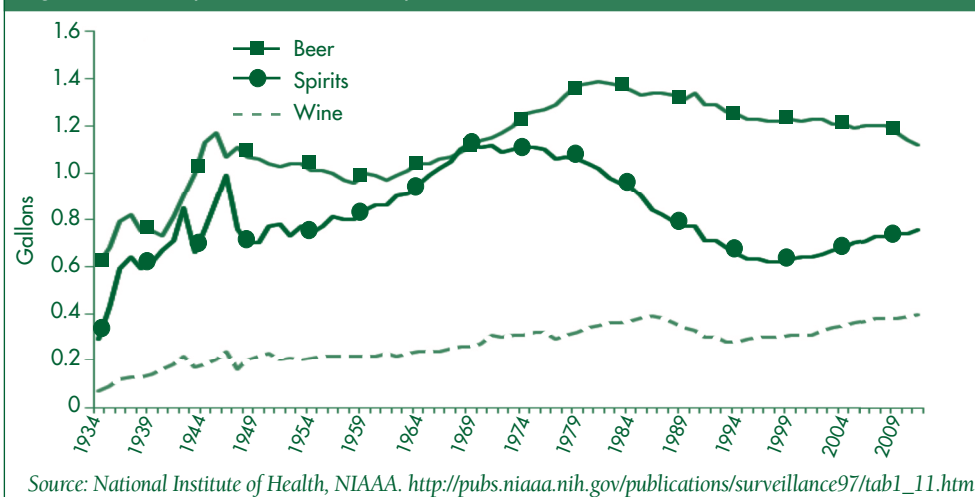
Investment Warning: Farming May Endanger Your Financial Health

Hoy F. Carman5

Obesity in Mexican-Origin Children

Richard Green, Arthur Haverter, Adela de la Torre, and Nan Zhang.....9

Figure 1. Per Capita Alcohol Consumption, United States, 1934–2009



and factories that use forest and food residue to produce building materials.

The supply chain of the various sectors of the bioeconomy may give rise to interesting industrial structures. For example, in the poultry sector, Tyson Foods supplies feedstock to farmers who raise chickens. In turn, Tyson processes the chicken into various products. The interaction between Tyson and the chicken farms is through contract farming. Other chicken processors such as Foster Farms use vertical integration—and own the chicken farms.

Further, the development of the bioeconomy is subject to government regulations on acceptable technologies. For instance, genetically modified crops are banned in many parts of Europe but used in some parts of the United States. It is interesting to understand the factors that drive the emergence of supply chains and the different ways they are regulated.

The potential of the bioeconomy has been enhanced immensely by the discovery of DNA and new technologies that utilize modern molecular biology, genetics, and information technology. While the bioeconomy seems like a new and modern system, actually the old bioeconomy is one of the oldest industries. The old bioeconomy relied on fermentation to produce alcoholic products like

wine, beer, vodka, pickled foods (like kimchi), and cheeses of various types.

The old bioeconomy provides some valuable lessons for the new bioeconomy. One of the most important case studies is beer, which we emphasize below. A large body of research has focused on beer, including an informative book by Jo Swinnen, *The Economics of Beer*, as well as several other books and websites dedicated to this subject.

The Evolution of Beer

It seems from the blogs that it's unclear which came first: beer or bread. Historians speculate that prehistoric nomads may have made beer from grain and water before learning to make bread. The ancient Egyptians who built the pyramids got paid by beer, bread, and green onions.

Different cultures rely on available grains to produce beer. They use millet, maize, and cassava in Africa, agave in Mexico, and rice in Japan. The Egyptians grew a specific variety of barley for brewing beer, and beers were part of many medical prescriptions in Egypt and many other cultures. Even before people knew about germs, they realized that beer and alcohol protected them against contaminated water.

Also, alcoholic beverages provided nourishment, pain relief, and socializing. People consumed different drinks according to their needs. For

example, in the Middle Ages, low-alcoholic beer was called 'Small Beer' as a safe alternative to water. Higher alcohol content beer (4%) was used as part of regular meals, and even higher content (6%) was used in festivals. This is part of the differentiation that became a characteristic of the beer sector. Concern about quality and market power led to the establishment of a brewing guild in Germany, as well as purity standards in the 15th century.

Production of beer has industrialized. In early times, families brewed beer. Then it shifted to centralized production and became a source of income for monasteries and convents. Eventually, breweries became independent businesses that were selling beer both on the premises and in containers to go.

The production of beer evolved over time. In the early days, it required some grain, water, and the addition of herbals for flavoring. Since the Middle Ages, the use of hops replaced most of these flavorings. In 1876 Pasteur unraveled the secrets of yeast in the fermentation process, and he also developed pasteurization to stabilize beers 22 years before the process was applied to milk.

Currently, there is a specialized industry producing different varieties of yeast for beer. The West Coast, and especially the Yakima Valley in Washington, specializes in hops, which is a high-value crop that is managed effectively through contracts. Brewers operate barley breeding programs to produce malt that will result in beer with specific flavors. However, the barley industry, which is a low-value crop, is declining in both the United States and Canada.

Taxation of beer was a major source of income for governments. Jo Swinnen suggested that the Low Countries (Holland and Belgium) won their independence from the Spanish because of beer. They financed their armies from beer tax, while the Spanish relied on tax on silver. The beer won.

Beer was very important in the history of the United States. In 1620 Pilgrims land at Plymouth Rock because the beer supplies were running low. The soldiers of the Revolutionary Army received a quart of beer a day. Beer was taxed, but James Madison suggested a low duty in order to encourage beer production in the states.

Prohibition in the United States was a traumatic event for the beer industry, when more than 80% of the breweries disappeared. However, those that survived became stronger, according to Carlos Hernandez, an economic historian from UCLA. Survivors switched to other drinks, such as sodas, and I imagine that during Prohibition, they were able to gain a foothold in the black market.

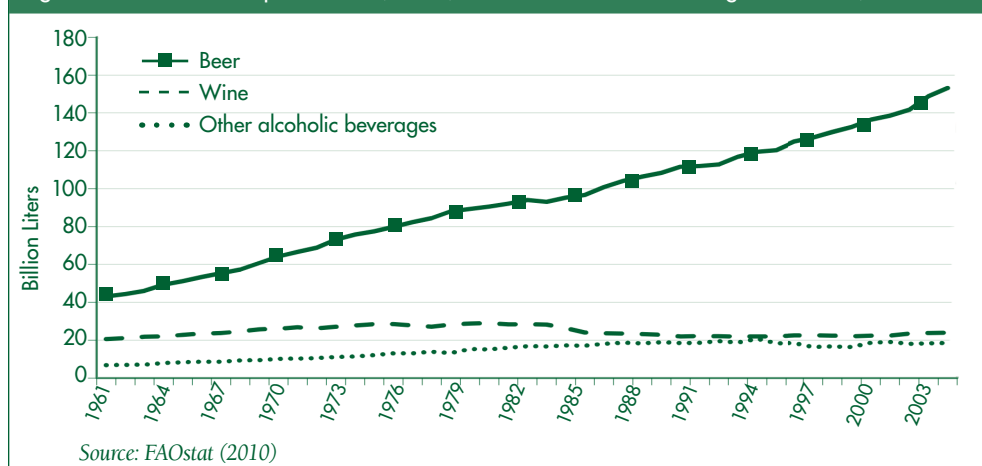
Another economic historian, Martin Stack from Saint Louis University, suggested that between the 1870s and 1950s, the poor were drinking local, unpasteurized beers with many exotic flavors, while the well-to-do middle class was buying more expensive pasteurized, uniform beer. After Prohibition, there was a period during which the big companies provided bland beer accessible to everyone.

And now, we live in a period of the budding sector of craft beers. The difference is that the middle-class pays the extra for the local, exotic beers, while individuals with lower income purchase the standard beers. For example, 46% of millennials claimed not to consume Budweiser.

Figure 1 suggests that beer has been the dominant alcoholic beverage in the U.S. over the past 100 years. Consumption of beer peaked in the 1910s, declined significantly during Prohibition, then slowly recovered until the 1980s—but has since declined. Wine consumption per capita has risen steadily since Prohibition.

Swinnen suggests that beer consumption increases with per capita income but once GNP per capita is

Figure 2. Global Consumption of Beer, Wine, and Other Alcoholic Beverages in Volume, 1961–2005



greater than \$30,000, beer consumption declines—this has been true in Germany, the United States, and Belgium. On the other hand, wine consumption increases with income. While overall consumption of beer is declining, production continues to increase due to export growth.

Figure 2 suggests that globally, on average, people consume more beer than any other alcohol and that the gap is increasing. The reason for the increase in beer consumption is that for most countries in the world, per capita income growth has been significant. However, average income still remains below \$30,000 per person annually and thus beer consumption continues to outpace other alcoholic beverages.

As Figure 3 shows, China overtook the U.S. as the largest overall consumer of beer at the beginning of the millennium, and Russia overtook Germany in overall consumption a couple of years later. Swinnen presents a more surprising finding in that Russians consume more beer than vodka today. He suggests that one reason could be that advertisements of vodka were disallowed in 1995.

Beer and the Bioeconomy

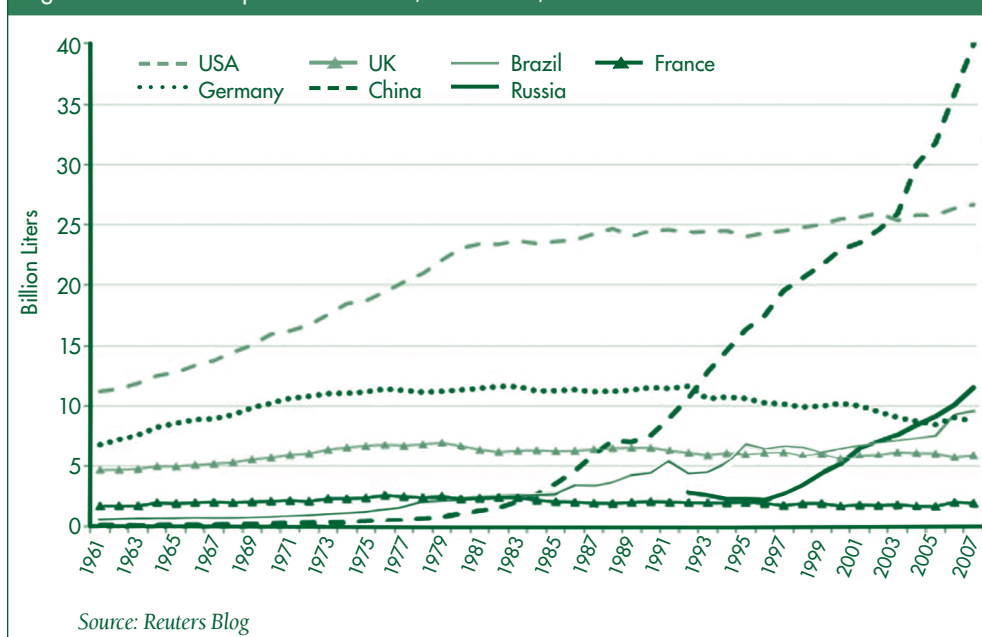
Beer is perhaps the oldest sector of the bioeconomy, and its history has many lessons for the modern bioeconomy. In the case of beer, feedstocks vary across locations and have changed over time.

Each of the main inputs to beer has its own supply chain. Grains, like wheat and especially barley, are major commodities. A small fraction of the overall output is directed to the production of beer. But, there hasn't been much effort to identify specialized grain varieties for the production of beer.

The emergence of the craft-beer industry—with its emphasis on product diversity and quality—provides the opportunity to establish a specialized malt-barley sector. In particular, the new tools of crop breeding could be employed to develop special varieties of barley that will provide improved flavors resulting in better beers. The case of beer illustrates how new technologies provide new opportunities and the importance of product differentiation in generating value in various segments of the bioeconomy.

The fermentation process has become a science based on increased selection and better management of yeast. The production of hops, which is a high-value crop, is done through elaborate contractual agreements that emphasize quality and there are ongoing processes to develop new varieties of hops. Beer companies also compete to upgrade the quality of their product by securing access to high-quality water. As the willingness to pay for beer increases, there will be continuous efforts to increase the quality of inputs. Furthermore, the supply chain of beer

Figure 3. Beer Consumption in the World, Billion Liters, 1961–2007



includes two modes: (i) large breweries that emphasize distribution through retail stores, and (ii) small breweries that focus on local markets and make much of their income on the premises of selling both beer and food items.

Technology and regulations are two drivers of the various sectors of the bioeconomy. The discovery of the use of hops in beer production around the 14th century improved quality and taste, as hops contribute bitterness (to counter the sweetness of barley), add flavor and aroma, and contribute to the preservation of the beer.

Refrigeration, gradually introduced in the 19th century and improved ever since, redefined brewing. In the 1870s, Adolphus Busch pioneered the use of double-walled railcars and a network of icehouses to make Budweiser the first national brand. Refrigeration improved production processes and created new types of beer, assured uniform products, and expanded the reach of breweries becoming a major source of economies of scale in beer production.

The history of beer at various locations was affected by its taxation, as well as regulation on alternative products such as wine. Regulations of production practices and

distribution were introduced for safety, as well as to serve the interests of various groups such as brewers.

The negative side effects of alcohol led to an excessive reaction in the form of Prohibition in the United States. But by 1933, society realized the folly of excessive regulation and bans, and repealed Prohibition. But even after Prohibition, breweries were denied the right to sell beer to the public. However, in 1982, State Assembly Bill 3610 passed, which legalized brewpubs in California. It was followed by similar legislation elsewhere and spawned the craft beer industry in the United States, which became the most creative and dynamic segment of the beer industry.

The rich history of beer illustrates the potential and the unpredictability of the nascent sectors of the bioeconomy. It demonstrates the expanding revenue potential originated in the agricultural sector as feedstock for new products. It also highlights the importance of cleverly designed supply chains for marketing differentiated, high-value, specialty products. These products can be sold through stores or through specialized outlets that can be controlled by the brewer. The future of the bioeconomy also depends on the capacity

of science to increase the diversity and safety of the product, and the necessity of creative regulations that ensure safety but don't impede creativity.

The story of beer suggests that expansion of the bioeconomy to other fields will provide many opportunities to expand farming to other high-value products. The structure of the industry that will produce this new source of feedstock will be unveiled over time; it is likely to emphasize use of contracting as well as vertical integration.

The new sectors of the bioeconomy may compete with traditional agricultural sectors for resources such as land and water. Recent concerns over availability of resources to produce both food and biofuel is an indicator of the potential for conflict. Thus, one of the challenges of traditional agricultural crops is to increase productivity to increase the production of non-conventional, high value-added products and develop safe, cost-effective ways to produce new feedstock.

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David Zilberman is a professor and holds the Robinson Chair in the agricultural and resource economics department at UC Berkeley. He can be contacted by email at zilber11@berkeley.edu.

Investment Warning: Farming May Endanger Your Financial Health

Hoy F. Carman

During the last 15 years, some two-thirds of individual taxpayers with farm income have reported total net farm losses averaging over \$11.1 billion annually. In addition, the U.S. Government participates in funding these losses by foregoing taxes on other sources of income from which farm losses are deducted. Persistent losses indicate that farming may have changed from an investment to a consumption good for many individual taxpayers.

An oft-repeated saying, “The best way to make a small fortune in farming is to begin with a large one” is popular in farm circles. While the source of the statement is now obscure, Internal Revenue Service (IRS) data for individual taxpayers reporting farm income and U.S. Department of Agriculture Census data on net farm income provide the rationale. These data indicate that a lot of people regularly lose a lot of money farming.

While the IRS definition of taxable farm income differs from USDA’s definition of net cash farm income, individual taxpayers and family farms have been incurring significant losses by either measure. Note that the farm audience tends to rely on USDA data sources and has limited exposure to IRS data. This report emphasizes IRS data.

Samples of income tax returns for farm proprietors filing Schedule F, Profit or Loss from Farming, as reported by the IRS, reveal that the majority of farm sole proprietorships

report net losses from farming and that total losses far outstrip total reported net profits. Census of Agriculture data for 2012 also show that the majority of individual and family farms reported negative net cash farm income.

Summary of Annual Schedule F

Individuals filing Schedule F, Profit or Loss from Farming, must complete Part I, Farm Income, and Part II, Farm Expenses, which are used to calculate net farm profit (or loss). The net profit or loss is then entered on the Individual Income Tax Return, Form 1040, and Schedule SE. The income categories on Part I include sales of livestock and farm products, cooperative distributions, agricultural program payments, crop insurance proceeds, custom hire, and other income. The farm expenses

in Part II include categories for all of the major farm inputs, as well as car and truck expenses, taxes, interest, utilities, depreciation, and other costs attributable to the farm business.

The net profit or loss from farming entered on Form 1040 is one of the categories of total income that, after adjustments for 13 categories of expenses (such as the IRA deduction, self-employed health insurance deduction, one-half of self-employment tax, health savings account deduction, and self-employed SEP, SIMPLE, and qualified plans), yields adjusted gross income.

During the 15-year period from 1999 through 2013, an annual average of 69% of individual taxpayers with farm income reported an annual net loss averaging \$16,400 (Table 1). The

Table 1. Number of Individual Taxpayers with Farm Profits or Farm Losses and Amount of Profit or Loss, 1999–2013

Year	Returns with Farm Net Income			Returns with Farm Net Loss		
	Number of Returns	Total Profits \$Billion	Average Profit \$/Return	Number of Returns	Total Losses \$Billion	Average Loss \$/Return
1999	725,782	9.201	12,678	1,320,526	15.444	11,695
2000	703,083	8.270	11,763	1,358,701	17.305	12,736
2001	649,173	7.657	11,795	1,357,698	18.661	13,745
2002	556,331	6.324	11,367	1,438,741	20.744	14,418
2003	592,019	7.473	12,622	1,405,097	19.844	14,123
2004	588,823	7.371	12,518	1,416,076	20.610	14,554
2005	610,647	8.484	13,894	1,370,603	20.653	15,068
2006	551,965	7.684	13,921	1,406,308	23.015	16,366
2007	555,923	9.931	17,864	1,422,020	24.625	17,317
2008	548,789	11.749	21,409	1,399,265	26.596	19,007
2009	523,107	11.616	22,206	1,401,107	25.711	18,351
2010	582,602	12.252	21,030	1,303,456	23.302	17,877
2011	613,864	16.384	26,690	1,266,450	23.495	18,552
2012	607,335	20.856	34,341	1,238,006	25.913	20,932
2013	613,206	19.421	31,672	1,215,052	25.884	21,303
Average			18,385			16,403

Source: IRS, SOI Tax Stats. Individual Income Tax Returns, Annual Reports. <http://www.irs.gov/uac/SOI-Tax-Stats-Individual-Income-Tax>Returns>

Table 2. Percentage Distribution of Individual Income Tax Returns with Farm Profits and Losses by Size of Adjusted Gross Income, 2013 tax year

Item	Number of Returns and Total Profits/Losses	-----Size of Adjusted Gross Income-----						
		Under \$15,000	\$15,000 under \$30,000	\$30,000 under \$50,000	\$50,000 under \$100,000	\$100,000 under \$200,000	\$200,000 under \$250,000	\$250,000 or more
Percent of total for each category								
Returns with Profits								
Total Returns	613,206	16.2	11.3	15.8	27.1	20.8	2.6	6.2
Total Profits	19,421,491	4.8	4.3	7.1	19.8	26.7	7.8	29.5
Returns with Losses								
Total Returns	1,215,052	17.6	12.5	14.9	30.1	17.0	2.5	5.4
Total Losses	25,884,248	30.4	8.4	10.8	19.8	14.0	2.7	13.9

Table Source: IRS, SOI Tax Stats. Individual income tax returns, 2013 tax year.

portion (31%) of taxpayers with net profits from farming reported an annual net profit averaging \$18,385. Several aspects of data in Table 1 are worth noting. First, the number of individual taxpayers reporting farm income has decreased over time, from a total of 2,046,308 in 1999 to 1,828,258 in 2013.

Second, not only is the number of individual taxpayers reporting farm losses greater than the number reporting profits, but the total losses are always greater than total profits. For the years shown, annual total losses exceed total profits by a range of \$5.06 billion in 2012 to \$15.33 billion in 2006, with the average annual difference being \$11.48 billion. Both average farm profits and losses per taxpayer have increased over time when measured in either current or real dollars, with the increase in farm profits per taxpayer being greater than the increase in farm losses.

There has been a decrease over time in the number of individual taxpayers reporting farm income, but the proportion of returns reporting net losses was nearly the same in 2013 (66%) as it was in 1999 (65%). This seems to indicate that individuals no longer reporting farm income were proportionally represented by farms with both profits and losses.

The IRS classifies individual

taxpayers with farm profits and farm losses by various size categories of adjusted gross income. Note that farm losses are deducted from, and net farm profits are added to, other sources of income to obtain adjusted gross income. Table 2 shows the percentage distribution of total farm losses and net farm profits, together with individual taxpayers by adjusted gross income categories.

Over the last 15 years, approximately two-thirds of individual taxpayers with farm income have reported net losses from farming and only one-third report taxable profits.

The percentage distribution of individual taxpayers by income category is quite similar for those with both profits and those with losses from farming (Table 2). The majority of taxpayers with farm income are in the three gross income categories ranging from \$30,000 to under \$200,000, including 63.7% of taxpayers with farm profits and 62% with losses.

Most of the total profits from farming (83.8%) were accounted for by taxpayers with more than \$50,000 of adjusted gross income. On the loss side, almost one-half (49.6%) of total losses from farming by individual

taxpayers were in the three adjusted gross income categories under \$50,000.

For the top two gross income categories (\$200,000 to \$250,000 and over \$250,000), 7.9% of individual taxpayers with farm losses in 2013 had adjusted gross incomes of over \$200,000 after deducting farm losses from other income. These same taxpayers accounted for 16.6% of total farm losses for individual taxpayers (Table 2).

USDA Net Cash Farm Income

The 2012 Census of Agriculture counted a total of 1,828,946 family or individual farms, the category most closely matching the IRS's individual taxpayers category. The Census of Agriculture also counted 137,987 partnerships, 106,716 corporations, and 35,654 other legal organizations (cooperative, estate or trust, institutional, etc.). Thus, family or individual farms accounted for 86.7% of the total 2,109,303 U.S. farms.

Of the 1,828,946 Census family and individual farm operators, 803,688 reported net gains totaling \$59.48 billion, while 1,025,258 reported net losses totaling \$18.19 billion. Thus, family or individual farms accounted for \$41.29 billion (52.6%) of total 2012 U.S. net cash farm income of operators, while the farm

partnership and corporation shares were 22.6 and 23.4%, respectively.

The Census of Agriculture presents net cash farm income for operations and for operators. The data for operators is presented here since each operator presumably files a Schedule F as part of the annual income tax return. There were 803,688 farm operators who reported net gains averaging \$74,009 per operator in 2012. At the same time, there were 1,025,258 family or individual farm operators who reported net losses averaging \$17,739. Overall, net cash farm income totaled \$41.29 billion for an average of \$22,577 for 1,828,946 farms.

The 2012 distribution of net gains and net losses is shown in Table 3. Of the 803,688 family or individual farms with positive net cash farm income, over 57% (460,465) had net gains greater than \$10,000, while 43% had gains totaling less than \$10,000. At the same time, 37% of the farms with losses had net losses greater than \$10,000, while 63% of the farms had losses of less than \$10,000.

Farm Income – IRS vs. USDA

The IRS and USDA farm income data paint slightly different pictures of individual and family farm income. In 2012 the IRS reported a total of 1,845,341 individual taxpayers with farm income; 607,335 reported profits from farming amounting to \$20.85 billion, while 1,238,006 reported total losses from farming of \$25.91 billion—for a net loss of \$5.06 billion from farming (Table 1). The 2012 Census counted 1,828,946 family and individual farm operators; 803,688 reported net gains totaling \$59.48 billion, while 1,025,258 reported net losses totaling \$18.19 billion for net cash farm income totaling \$41.29 billion.

A portion of the differences in number of farms and net farm income are due to differences in definitions. IRS counts an individual

Table 3. Distribution of Net Gains and Losses for Net Cash Farm Income of Family or Individual Farm Operators, 2012 Census of Agriculture

	Amount of Net Gain or Net Loss per Farm					
	Less than \$1,000	\$1,000 to \$4,999	\$5,000 to \$9,999	\$10,000 to \$24,999	\$25,000 to \$49,999	\$50,000 or More
Number of Farms with Gains	73,337	167,363	102,523	139,921	98,637	221,907
Percent with Gains	9.13	20.82	12.76	17.41	12.27	27.61
Number of Farms with Losses	90,636	322,255	231,103	234,824	86,705	59,735
Percent with Losses	8.84	31.43	22.54	22.90	8.46	5.83

Source: 2012 Census of Agriculture, Table 67, Summary of Legal Status for Tax Purposes.

taxpayer that reports farm income on Schedule F as a farmer. The Census requires at least \$1,000 of gross annual sales to be a farmer. This difference in definition helps to explain the difference in number of farm taxpayers and number of farms.

The differences between the IRS farm income reported on Schedule F and the Census measure of net cash farm income are largely due to differences in the costs included. The major difference is that IRS farm income includes depreciation and employee benefit programs; net cash farm income does not include depreciation, perquisites for hired labor, or other noncash expenses. Note that the USDA also reports annual data on net farm income that includes depreciation, perquisites for hired labor, other noncash expenses, and some inventory adjustments, but without the detail found in the Census.

While one can choose the farm income measure used to evaluate the well-being of the agriculture sector, the IRS data has the appeal of measuring individual transactions. The IRS statistics on individual taxpayers' farm income, however, do not tell a very encouraging story. Over the last 15 years, approximately two-thirds of individual taxpayers with farm income have reported net losses from farming and only one-third

report taxable profits (Table 1). In addition, total losses typically exceed profits by a substantial margin.

Negative net farm income reported by individual taxpayers is a long-standing and persistent problem, both in terms of maintaining a healthy agricultural economy and funding government operations. The persistent losses illustrate the willingness of individuals and families to subsidize their farming activities with income from other sources. This subsidy is possible because of nonfarm income.

As noted by the Census, over 72% of individual and family farm operators derived less than 25% of total household income from farming; only 5% derived all of their household income from farming. The U.S. Government is also partnering in the farm losses. On the Form 1040, net losses on Schedule F are deducted from other income resulting in a reduction of adjusted gross income and income taxes due. For example, a married couple in the 25% tax bracket with \$4,000 of farm losses would receive a refund of \$1,000 from taxes paid on nonfarm income.

Given the distribution of net profits and losses by adjusted gross income (Table 2), one can safely conclude that the U.S. Government could increase total income tax revenues by not taxing income from individual and

family farm operators and, importantly, by not allowing net farm losses to be deducted from other income.

Why Lose Money Farming?

A natural question is “why do individuals and families whose principal source of income is off-farm continue to subsidize farming activities?” Various explanations are offered including farming as a lifestyle, preference for rural residence, a desire to produce organic products, beginning farmer, retirement farm, animal ownership, land as an investment, sustainability and environmental concerns. Note that it is likely that most farmers expect to recoup their losses at some point in time.

There are income tax rules that could encourage continued investment in agricultural production activities, even though short-run losses are occurring, but we can only speculate on the extent of the role they may be playing in the farm losses described above. These tax rules include the deductibility of farm losses from nonfarm income, cash accounting, Section 179 expensing, and capital gains provisions.

Farming is the only enterprise with significant inventories that can use cash accounting in determining taxable income. Cash accounting can provide some flexibility on timing the realization of income and expenses, reduce taxable income in the short-run, and defer some income taxes. It is likely that some of the reported farm losses would not occur with accrual accounting.

Tax rules applied to capital investments, including expensing and additional first-year depreciation, undoubtedly play a role in some farm losses. Investments in machinery, equipment, and other depreciable capital may be treated as a current expense or capitalized and depreciated over time. The amount of capital investments eligible to expense immediately

(Section 179 property) has increased over the last 15 years as Congress has sought to stimulate the economy.

The expensing limit was \$20,000 in tax year 2000. The amount increased to \$24,000 in 2001 and 2002, and jumped to \$100,000 in 2003. With indexing, the expensing limit increased to \$125,000 in 2007 and then doubled to \$250,000 in 2008 and 2009. The Small Business Jobs Act of 2010 again doubled the expensing limit to \$500,000 for property placed in service in tax years 2010 and 2011. Congress maintained the expensing limit at \$500,000 for 2012, 2013 and 2014, but the 2015 limit was reduced to \$25,000. Note, however, that Congress can restore expanded Section 179 limits during 2015, as was done in 2013 and 2014.

The advantage of capital gains tax rates that are lower than the rates on ordinary income encourage investment in assets subject to capital gains, and farmers tend to have a higher proportion of their income in capital gains than does the average taxpayer. Farm assets that qualify for capital gains, subject to specified holding periods, include cattle, horses, and other livestock held by the taxpayer for draft, breeding, dairy or sporting purposes, land and other business property. The amount of capital gains available for some farm assets, i.e., livestock, can be increased by the ability to deduct costs of maintenance and depreciation. Thus, capital gains provisions are likely a factor associated with farm losses.

Conclusions

Having a small farm appears to be a continuing drain on household income for many families. Some two-thirds of individual taxpayers filing a farm tax return (Schedule F) have reported farming losses over the past 15 years and this proportion has been fairly steady from year to year. While income tax rules applicable to farm investments provide some mitigation,

individual taxpayers' farming losses continue to be significant. Appropriate advice may be to paraphrase the Country/Western song first recorded by Ed Bruce in 1975 and made popular by Waylon Jennings and Willie Nelson in 1978, “Mammas Don't Let Your Babies Grow Up to Be Farmers.”

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Hoy F. Carman is a professor emeritus in the agricultural and resource economics department at UC Davis. He can be reached by email at carman@primal.ucdavis.edu.

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Obesity in Mexican-Origin Children

Richard Green, Arthur Havenner, Adela de la Torre, and Nan Zhang

Research results from the *Ninos Sanos, Familia Sana* project found that mothers have a dominant role in the weight of their children. Obese children are more prone to gain more weight, at the margin, if their mothers are overweight. Other factors are also important in explaining obesity in Mexican-origin children.

Obesity among adults and children is a serious health problem. According to the Food and Agriculture Organization of the United Nations' (FAO) most recent estimates of the world population, 795 million go to bed hungry or suffer undernourishment regarding energy intake. At the same time, 1.4 billion people are overweight, of whom 500 million are obese; see Figure 1. Overweight and obesity can lead to diseases linked to type II diabetes, heart disease, and cancer. Most of the world's population lives in countries where overweight and obesity kills more people than underweight. Worldwide, forty-two million children under the age of five were overweight or obese in 2013.

For adults, the U.S. Centers for Disease Control and Prevention (CDC) classify persons obese if they have a body mass index (BMI) of 30 or greater, and overweight if they have a BMI of 25 or greater. For children, the CDC's guidelines are: normal-weight (5th–84th percentile), at-risk-for overweight (85th–95th), and overweight (>95th). Hammer et al. BMI Z-scores adjust BMI's for normal growth rates of children and are widely used to classify children as normal, overweight, or obese.

There are many approaches to explaining the causes and prevention of

obesity, which can be broadly grouped into medical, nutritional, social/cultural, and economic. This paper focuses on the socio-economic explanations of obesity. In particular, some reported empirical results help to explain the high rates of obesity in Mexican-origin children in California's Central Valley.

Economic Approaches

Philipson and Posner, two economists, attribute the long-run growth in the number of overweight and obese people to two primary factors. Technological changes have lowered both the real price of food and reduced the amount of physical activity in the workplace. These changes have both lowered the cost of consuming calories and raised the cost of expending them.

Regarding causes of overweight and obesity in children, they state some plausible factors. Children's eating and exercise routines are strongly influenced by their parents, they spend more time watching television and playing video games, and with more and more parents working outside the home, children's health habits are less monitored.

Cost of Obesity

There are several economic costs associated with obesity: (1) direct healthcare costs associated with obesity-related

diseases such as treatment for hypertension, diabetes, coronary heart diseases, strokes, asthma, and arthritis, (2) decreased worker productivity and increased absenteeism, (3) higher workers' compensation claims, (4) emergency transportation and safety costs, and (5) human capital costs.

In the United States, numerous cost studies have been performed. Table 1 on page 10 summarizes a few of the estimates of obesity and obesity-related costs in the United States.

Cost-Benefit Analysis

Roux and Donaldson argue that the role of economics is not in measuring the economic burden of obesity, as Table 1 illustrates, through so-called cost-of-illness studies. Such studies merely, they assert, confirm that obesity is a serious societal issue and adding a monetary figure to this does not add much. Instead, they believe that the real value of economics lies in evaluation, through cost-benefit analyses of different strategies to prevent and treat obesity.

Research results from our recent USDA-funded project, *Ninos Sanos, Familia Sana*, found that a multifaceted intervention, community-based empowerment approach significantly reduced the rates of weight gain among obese Mexican-origin boys and

Figure 1. Worldwide Hunger and Malnutrition vs Overweight and Obese

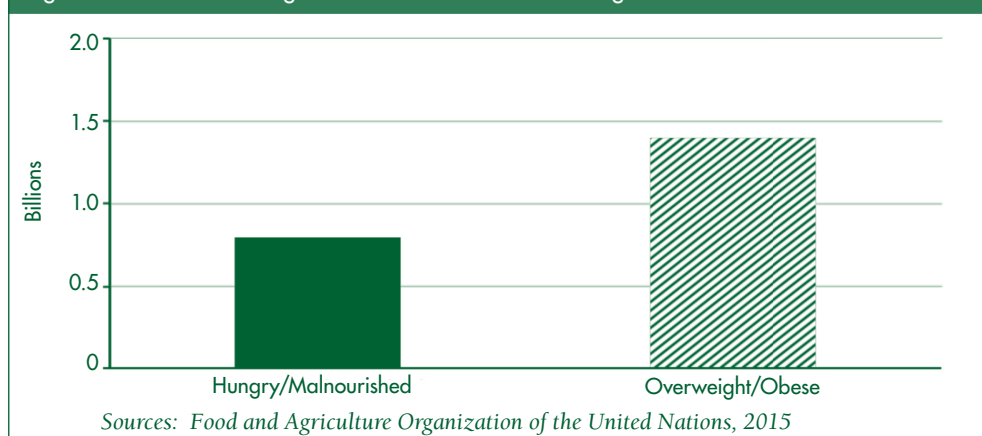


Table 1. Economic Costs of the Obesity Epidemic in the United States

Cost Category	Total Costs (Billion/Yr.)
Direct Medical Spending (Childhood Obesity)	\$147.0-\$210.0 \$14.0
Productivity Costs (Absenteeism, etc.)	\$4.3
Transportation Costs	\$2.0-3.0

Sources: Cawley, 2010; and Hammond and Levin, 2010.

girls in California’s Central Valley.

Theoretical Economic Models to Explain Health (Obesity) Problems

Michael Grossman, widely cited for his health care modeling approach, assumes that the individual makes decisions about how much to invest in his stock of health capital at any instant. He/she does this on the basis of a calculation of the costs and benefits, where both costs and benefits are distributed over time. The benefits side of the calculation has two components: consumption benefits, in the sense of the direct utility that an individual receives as a result of being healthier, and investment benefits, which refer to the impact of the individual’s health on their income.

Green et al. (2015) have applied some aspects of this approach by estimating a health production function of children using a hedonic model and using baseline data from the *Ninos Sanos, Familia Sana* project. As Figure 2 demonstrates, Mexican-origin children in our sample in California’s Central Valley are grossly overweight relative to the reference population based on a similarly aged group in the United States. The mean of the adjusted BMI (adjusted for age and rate of growth of a child, known as z-scores) should have a mean of zero—but the distribution in Figure 2 balances on one, not zero.

The implication of this is that only approximately 16% of Mexican-origin children in our sample are below the mean of BMI, compared to the 50% of the reference population of children in the United States who are below the mean BMI z-score of zero

(by construction of the standardized z-score). In other words, the average Mexican-origin child’s BMI is larger than all but 16% of U.S. children as a whole.

Based on a cross-sectional data set of over 300 Mexican-origin children in California’s Central Valley, Green et al. found that the mother has the dominant role in the weight of her children. However, the amount of inactivity in children per day, budget shares of certain food products, acculturation, and other factors also have a significant effect on Mexican-origin children being either overweight or obese.

More specifically, the mother’s BMI has a positive impact on the weight of their children. For example, for the majority of children in the middle-weight category, there is a 13% marginal increase in the child’s BMI for a marginal increase in the mean of the mother’s BMI. For children in the obese category, there is a 27% increase in a child’s BMI at the mean of the mother’s BMI. Thus, obese children are more prone to weight gain, at the margin, if their mothers are overweight.

In this study, the mothers were largely of children between the ages of 3-8 years of age. Thus, these observations indicate that, particularly for young children, a mother’s role is very significant in the nutritional choices and development of food preferences for her children. Also, another interesting observation from this sample was that the longer the parents are in the United States, the more weight the children gain (based on z-scores adjusted for normal growth rates).

Although we understand that lack

of physical activity is an important driver of greater weight gains in children, as is the consumption of more high-energy dense foods, it is clear from the above observations that other factors may come into play when addressing young children’s nutrition and physical activity behaviors.

Food Insecurity and Poverty

What is the association between food insecurity and obesity? Lucia Kaiser et al. found that Latino households in the United States report relatively high levels of food insecurity compared with other ethnic groups. Their research finds a significant association between deepening food insecurity and (1) declines in household food supplies; (2) less frequent fruit and vegetable consumption; (3) higher levels of unemployment; (4) increased participation in food assistance programs; and (5) disordered eating behaviors.

Families that frequently experience food insecurities may purchase less healthy foods because they are, in general, cheaper or easier to prepare. Lower-priced foods are usually more energy-dense and contain lower quality nutrient intakes than other foods. Thus, food insecurity may lead to more overweight and obese children and adults through lowered consumption of vegetables (fruits can be very fattening) and disordered eating habits.

Importance of Exercise

Furthermore, our qualitative observations from *Ninos Sanos, Familia Sana* suggest that community-wide interventions that target improved nutrition and healthy living spark greater community engagement to support increased physical activity programs for children and their parents. For example, as a result of the community empowerment approach utilized in our study, combined with our culturally tailored nutrition intervention, our target

community of Firebaugh developed programs such as community walking programs, after-school ballet, and girls' softball programs.

Increasing physical activity requires both convincing those who need it to participate and making facilities available that they will likely use. For children, schools need to increase support for non-competitive exercise both through enhanced physical education programs, as well as after-school physical activity programs. Schools might reasonably consider facilities for vigorous, non-competitive exercise in addition to their competitive programs.

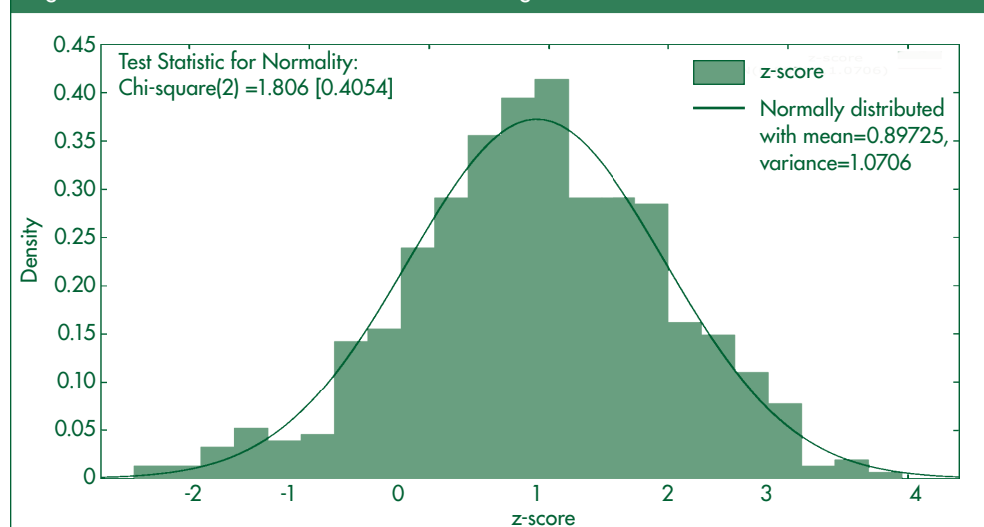
Virtually anyone who wants to exercise can, at some cost. Increasing physical activity becomes an issue of convincing people to participate, and perhaps lowering the cost. Convincing people to participate involves marketing campaigns and requires creating the type of community environment that supports and nurtures healthy behaviors. Lowering the cost is more problematic as it requires policy makers to address the broader structural inequities that exist across communities, as well as the adverse behavioral impacts resulting from food or income insecurity.

Nevertheless, given the growing health risks and health costs associated with the growth of obesity across the world, these issues require targeted interventions focused on key household decision makers—more often than not young mothers—as well as broader input from communities that are disproportionately affected by this growing epidemic. Also, ensuring that these interventions are culturally sensitive and sustainable over time is critical in supporting long-term behavioral change in many low-income and under-resourced communities, particularly in rural areas.

Conclusions

Obesity is endemic worldwide, especially in wealthier countries such as the United States and the European

Figure 2. Distribution of Z-scores of Mexican-Origin Children



countries. However, Mexico, northern African countries, and some other countries also have very serious problems with obesity. Furthermore, China and other nations are seeing a rise in obesity rates as their economies transition from rural to urban, with the attendant loss of physical activity. The increasingly sedentary world workforce, with electronic recreation through games and videos, etc., does not augur well for obesity.

The social and direct costs of obesity are clearly enormous. It is less clear what can be done about it. One can argue that society as a whole has an interest in minimizing obesity. But what is the role of government, schools, private companies, medical personnel, nutritionists, economists, and others? Our research and a survey of others' research indicate that the person who buys and prepares the food is the key, along with the amount of physical activity typically undertaken by each individual.

Thus, the prescription is to target the right person regarding nutrition and to facilitate physical activity for the whole family. It is clear to us that this common sense insight should underlie programs and policy prescriptions.

Economic analysis helps assess the efficacy of health care projects and, in particular, programs to reduce or

alleviate obesity by using a cost-benefit analysis. Applications of these methodologies are essential to appraise the economic feasibility of every proposed project.

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Richard Green is a professor and Art Havenner is a professor emeritus, both in the ARE department at UC Davis. They can be contacted by email at green@primal.ucdavis.edu and havenner@primal.ucdavis.edu, respectively. Adela de la Torre is the vice-chancellor of student affairs and director of the Center for Transnational Health at UC Davis. Nan Zhang is an undergraduate research assistant. This research was supported, in part, by an NIFA grant no. 2011-68001-30167.

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Department of Agricultural and Resource Economics
UC Davis
One Shields Avenue
Davis CA 95616
GPBS

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Julie McNamara, Outreach Coordinator
Giannini Foundation of Agricultural Economics
Department of Agricultural and Resource Economics
University of California
One Shields Avenue, Davis, CA 95616
E-mail: julie@primal.ucdavis.edu
Phone: 530-752-5346

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