

CM9: SUBSIDIES (1/21/19)

SOME, BUT NOT ALL OF, WHAT YOU SHOULD KNOW

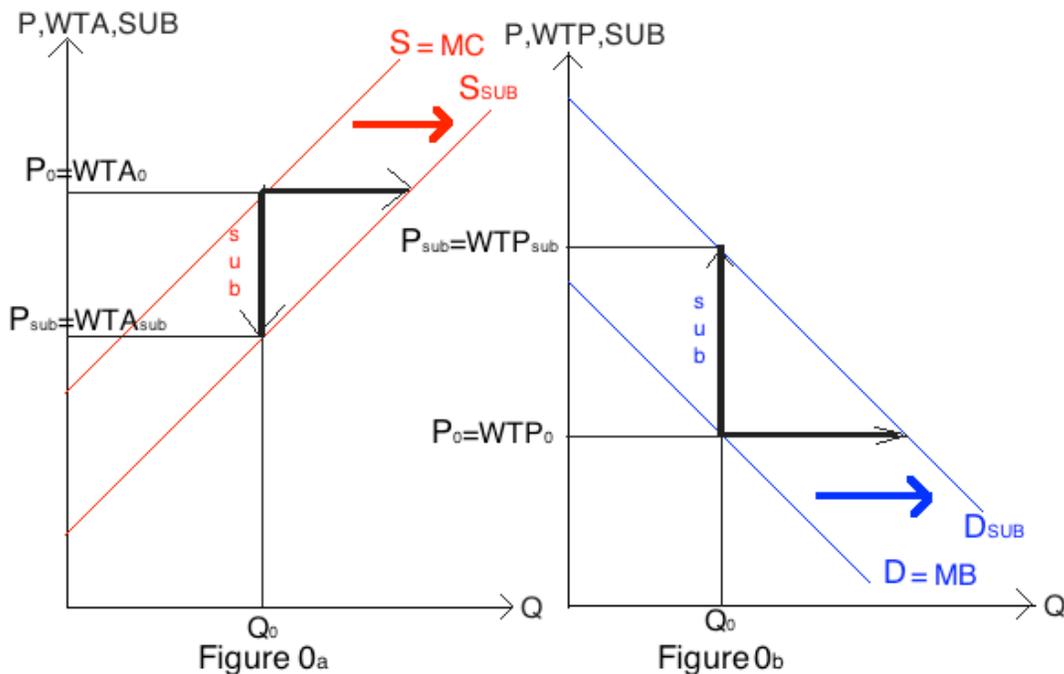
1. In what sense is a subsidy the opposite of a tax?
2. If the government provides a subsidy to producers what happens to the supply curve?
3. If the government provides a subsidy to consumers what happens to the demand curve?
4. Why does a subsidy generate a Dead Weight Loss?
5. How is the DWL shown on the standard supply and demand diagram?
6. Who pays the subsidy?
7. Why does it not make sense to talk about protecting family farms?
8. If subsidies were withdrawn from agriculture, would that lead to food shortages in the US?
9. Why do farm subsidies in the US and the EU hurt LDCs?
10. Why do economists describe agricultural supports as a special interest group problem?
11. Why do most subsidies benefit large farms rather than small farms?
12. Is it possible to devise a subsidy scheme that would largely benefit small farms?
13. If agriculture is good example of a competitive industry, what will be the long run

1. SUBSIDIES

1. A subsidy is the mirror image of a sales tax; a sales tax shifts the supply curve up and to the left; subsidies (on production) shift the supply curve down and to the right; taxes take away part of the firms' revenues, subsidies add to the firms' revenues. Remember that the supply curve is the willingness to accept (WTA) curve, it shows the minimum price that the firm would accept to produce the marginal unit (the price that just covers the marginal cost of production). The subsidy effectively makes the marginal unit more profitable and therefore the firm's WTA is lower and the supply curve shifts downwards.

In Figure 0a (which, of course, should be 10a!) before the subsidy firms will only produce the marginal unit, Q_0 , if they receive P_0 , which is just sufficient to cover their MC, P_0 therefore represents their WTA_0 . If the government gives the firms a subsidy equal to "sub" then the minimum price they will accept to produce the marginal unit, Q_0 , will drop by the amount of

the subsidy (represented by the downward pointing vertical arrow labeled **sub**). The new WTA is WTA_{sub} ; the old WTA less the subsidy. Firms will now be willing to increase the quantity supplied at each and every price by the amount of the horizontal shift of the supply curve. Economists usually emphasize the latter effect and say that the subsidy shifts the supply curve to the right, indicated by the red arrow.



2. Governments also subsidize consumers – the cash for “clunkers” program, tax relief on mortgages, medical benefits, pension benefits, social security – in which case the demand curve shifts down and to the right because the product has effectively become cheaper and so the quantity demanded increases at each and every price. This is because the demand curve is the willingness to pay, WTP, curve. If the price was \$5 and the government now provides a \$2 subsidy then the buyer will presumably be willing to pay \$7 for the marginal unit since she is effectively only \$5 out of pocket.¹

In Figure 0b before the subsidy consumers will only buy the marginal unit, Q_0 , if they pay P_0 , which is just equal to their MB_0 (P_0 therefore represents their WTP_0). If the government gives the households a subsidy equal to “**sub**” then the maximum price they will pay for Q_0 (the marginal unit) will increase by the amount of the subsidy (represented by the upward pointing vertical arrow). The new WTP is WTP_{sub} : the old WTP plus the subsidy. Consumers will now be willing to increase the quantity demanded at each and every price. Economists usually emphasize the latter effect and say that the subsidy shifts the demand curve to the right, indicated by the blue arrow.

¹ Of course, there will be administrative costs associated with the subsidy.

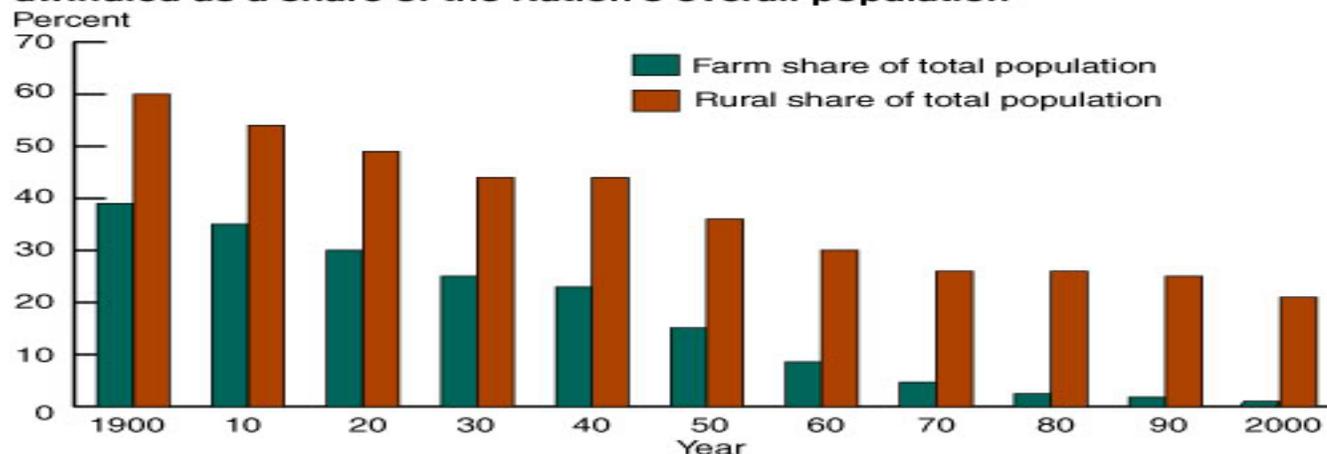
It is very important to remember that the analyses of Figures 0_a and 0_b refer to two *different* subsidies. In the first case the subsidy is paid to producers, in the second case the subsidy is paid to consumers. (I should have made the sizes of the subsidies different to emphasize that they refer to two different cases but I do not feel like redrawing the diagrams.) Figure 0 does **not** represent the effect of the same subsidy on firms and consumers. If this confuses you please ask me to go over the analysis again.

2. US AGRICULTURE

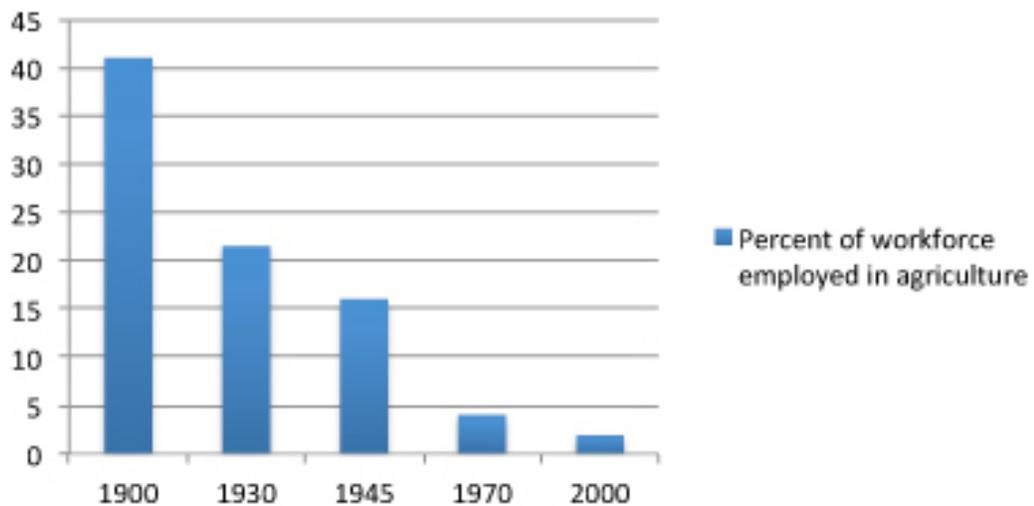
1. The US started life as a primary economy dominated by agriculture and extractive industries such as mining, forestry, and fishing. In the 19th century and the first half of the 20th century the US was a secondary economy with a dominant manufacturing sector. By the second half of the 20th century the US had shifted to a primarily service (tertiary) economy. As the US moves into the 21st century it is switching more and more to an information technology, IT, economy.

2. In the early part of the 20th century agriculture was labor intensive, and it took place on a large number of small, diversified farms in rural areas where more than half of the U.S. population lived. In 1900 farms employed about 40% of the U.S. workforce, using over 20 million work animals, mostly horses and mules, and usually produced more than five different outputs: various crops, livestock, chickens, pigs. At the beginning of the 21st century, we have a small number of large, highly specialized farms. Less than 2% of the labor force is employed in farming, although the food and agriculture sector is somewhat larger, and only about a quarter of the population lives in rural areas. Over 5 million tractors (that may cost \$150,000 or more) have replaced the horses and mules. In the last 114 years the number of farms has fallen by 63% and the size of farms has increased by about two thirds, although the amount of land farmed is about the same as in 1900. These farms are more specialized than in the early 20th century producing on average about five agricultural products.

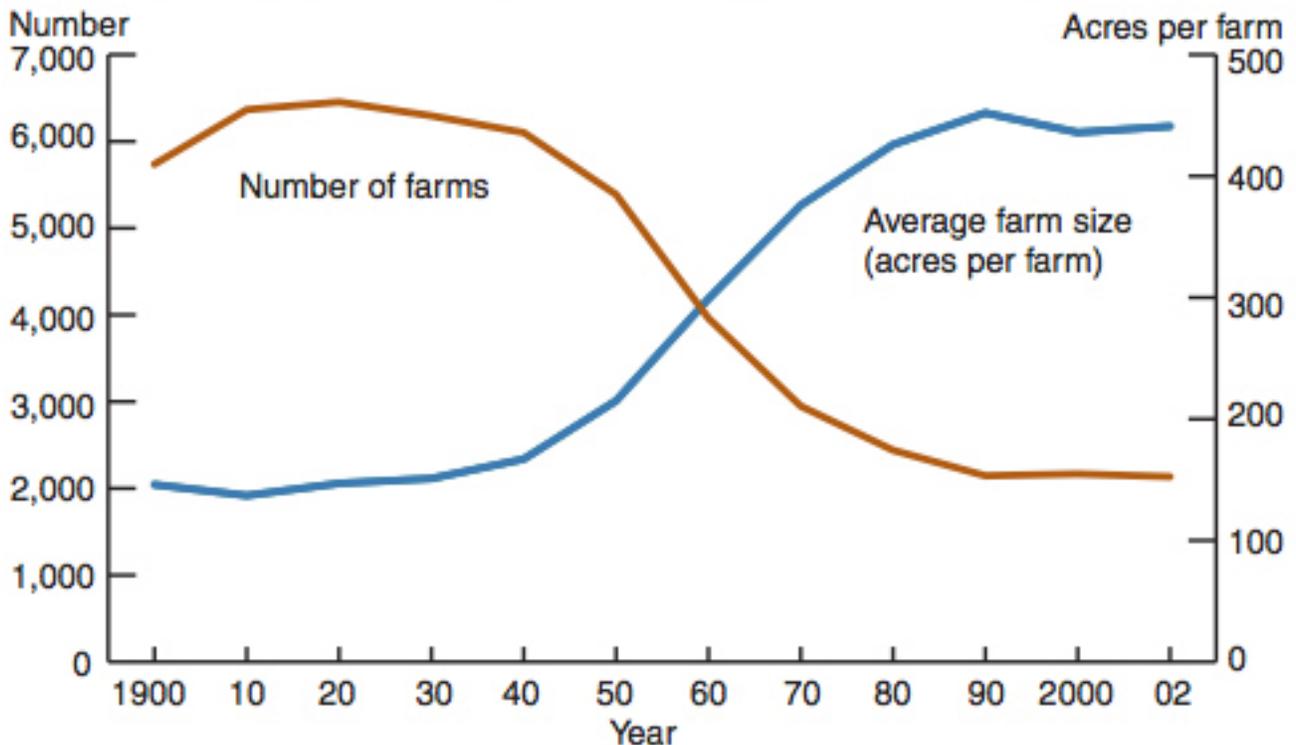
Figure 1
Both the U.S. farm population and rural population have dwindled as a share of the Nation's overall population



Agricultural employment



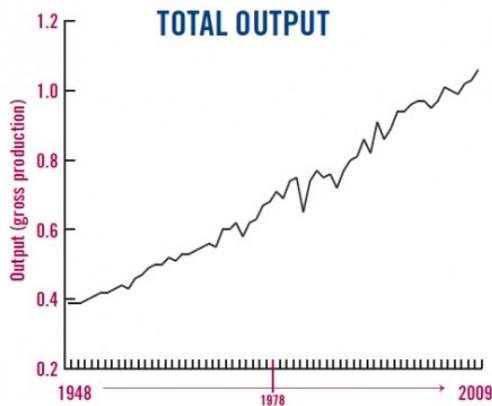
Number of farms vs. farm size



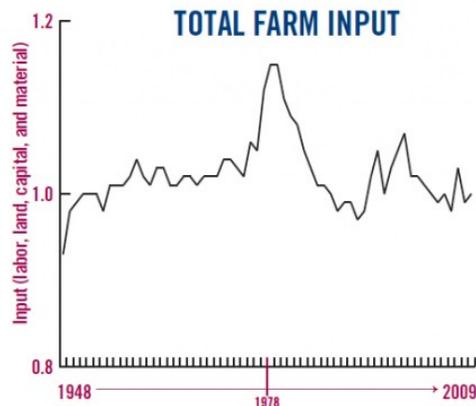
(An acre is about the size of a football field.)

3. Because there was rapid technological change in agriculture during the 20th century the smaller number of farms and reduced labor force now produce far more output than 100

years ago, although agriculture's share of GDP has been falling steadily since 1900 (7.7% in 1930 compared to 0.7% in 2002). In 2002 there were 2.2m farms in the US of which 90% were individual family farms, 6% were partnerships, 3% were family held corporate farms, and only 0.3% were corporate, non-family farms. The 7,000 non-family corporations farmed 1% of the total acreage, and produced 6% (\$13b) of \$200b total value of agricultural output.



SOURCE: <http://www.ers.usda.gov/data-products/agricultural-productivity-in-the-us.aspx#28247> TABLE 1



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3. CHANGES IN AGRICULTURAL OUTPUT

1. Agricultural output fluctuates because of yearly changes in growing conditions ("weather" is a supply shifter). Farmers plant their crops before they know what weather conditions will be like at harvest time. Figure 1 shows variations in supply shifting the supply curve to left and right. On average supply is equal to S_{AV} , but in bad growing years supply shifts leftwards to

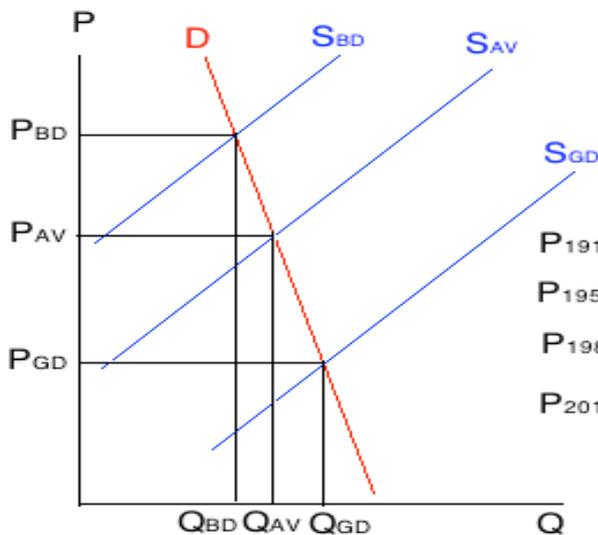


Figure 1

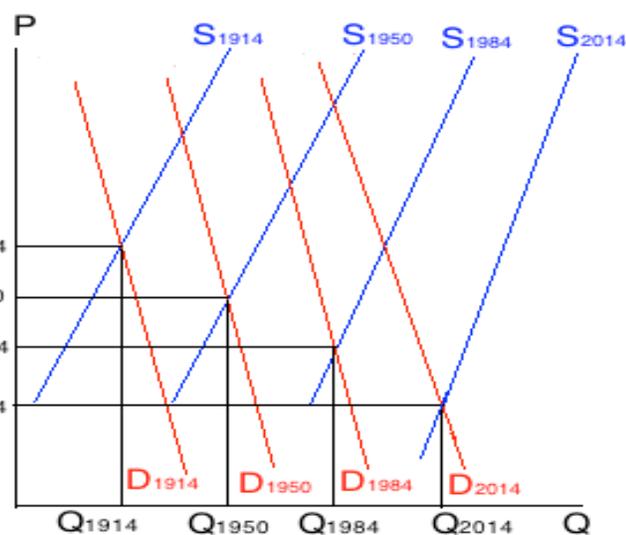


Figure 2

S_{BD} , and in good growing years supply shifts rightwards to S_{GD} . Farm income (before subsidies) is $TR = P \times Q$. The demand curve for food is relatively unresponsive to price (what economists refer to as relatively "inelastic") and so the demand curve is relatively "steep". This means that farmers' incomes fluctuate depending on whether growing conditions are good or bad or just average. These fluctuations in farm income can be partly smoothed by setting aside income in high-income years as a buffer to be used in low-income years. Farmers can also use "futures" markets to "lock in" prices, but a succession of bad harvests can ruin farmers, just as a recession can ruin small and medium sized firms.

2. Figure 2 shows (on an exaggerated scale) what has happened to farm output over the last century. Technological change has been very high and it has caused the supply curve to shift to the right; from 1938 to 2008 average agricultural productivity increased by about seven times, milk yield tripled, and new crops and hardier varieties of crops were introduced. In 2017 farming is a capital intensive and technologically sophisticated (global positioning of combined harvesters) industry. Part of the increase in farm size has been the consequence of "economies of scale" – farming a larger acreage lowers unit costs – in cereal production. Agriculture is also a global business – US farmers produce more food than US consumers can eat and the US is a major exporter of agricultural products. However, US agricultural productivity is often lower than European countries because Europeans farm more intensively than American farmers – applying more fertilizer, more labor, more capital per acre because land is a scarce factor of production in Europe. (European farmers also produce somewhat different crops).

3. Although demand has increased because of increased population, and because we consume larger portions and more calories than we used to, the shift in the demand curve has been small relative to the shift in the supply curve. Consequently food in the US is very inexpensive – we spend a smaller proportion of our budget on food in 2017 than we did in 1917.

4. SUBSIDIZING AGRICULTURE

1. Agricultural subsidies have grown rapidly since they were expanded in the 1930s. The 1930s was a bad decade for US agriculture because of poor growing conditions, drought in the Mid-West that led to the Dust Bowl, and low average prices because demand was relatively low as a result of the Great Depression, and a contraction in world trade. Rural communities were usually poorer than urban ones; rural poverty was particularly bad in the South. The 1930s saw many farm foreclosures, because farmers were not able to meet the payments on their bank loans. (This was the period portrayed in John Steinbeck's "The Grapes of Wrath", which was made into a famous film.) Subsidies were introduced in the late 1930s to help "family farms", which meant small family farms.

2. Agricultural subsidies have taken many forms: rural electrification, cheap water, cheap loans, government funded R&D, disaster relief, programs like ethanol subsidies, and direct price and

income supports – even paying farmers not to farm.

3. Figures 3a and 3b show how price supports work (the second sentence on the right should say target price not price support).

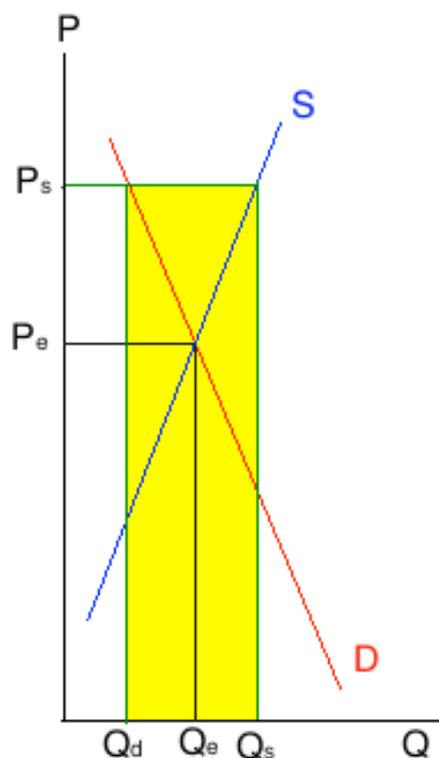


Figure 3a

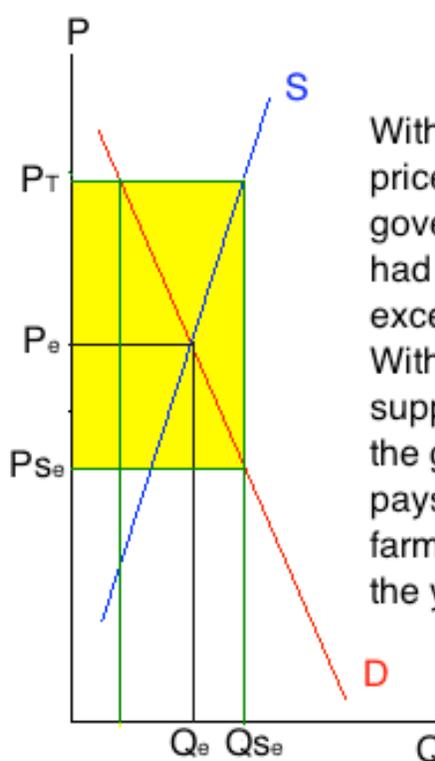


Figure 3b

With the support price system the government had to buy the excess supply. With the price support system the government pays a check to farmer equal to the yellow area.

In 3a I show the way in which the US used to maintain minimum prices for agricultural goods in the 1950s and 1960s. At P_s the quantity demanded is smaller than quantity supplied and prices would fall to P_e in a free market. But the government buys up the $E^s = Q_s - Q_d$. Consumers have to pay artificially high prices, taxes are used to buy the excess production, and the purchased crop has to be stored (in moth-balled aircraft carriers, the European Union's "mountain" of butter and "lake" of milk). Food Stamps are administered by the Department of Agriculture because they were introduced to help mop up surplus agricultural output. The yellow rectangle is the value of the excess supply ($P_s \times ES$), the amount of taxes that have to be raised to purchase the excess supply, but the cost of the subsidy should also include the storage costs of the surplus. The idea that the surpluses could be used to augment supply during years with poor harvests never worked because the support price was so high that the excess supply always swamped any need to supplement output in "bad" years. Sometimes the surpluses were dumped on less developed countries (LDCs) where the food was usually distributed in urban areas and local farm prices were depressed making rural poverty worse.

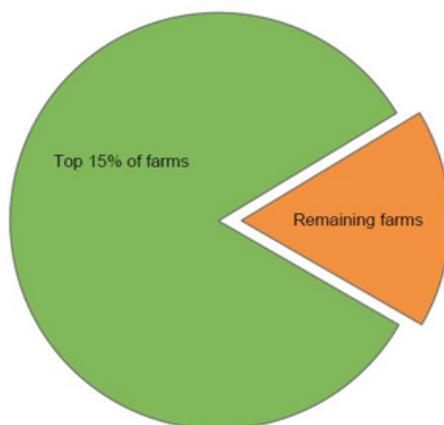
4. In 3b we see what happened in the 1970s and 1980s when the government switched to a

system of targeted prices (the old support prices renamed). Farmers were now guaranteed P_T per bushel and the quantity supplied at P_T becomes Q_{s_e} and the market price is established by supply and demand at P_{s_e} . Consumers pay $P_{s_e} < P_e$ and are better off than under the support system. The government simply writes a check to farmers equal to: $(P_T - P_{s_e}) \times Q^e$ – the difference between the target price and the equilibrium price times the number of bushels sold, Q_{s_e} . But the program costs the taxpayer the yellow rectangle. Which rectangle – the one in 3a or 3b – is larger depends on the slopes (elasticities) of the demand and supply curves. There is no storage cost under the target system and no surplus to dump.

5. Both systems encourage farmers to increase supply and to engage in intensive farming (for example, the heavy use of pesticides). The USDA tried crop limitation in the 1980s but farmers let their low yielding acres lie fallow and farmed the subsidized ones more intensively and so the reduction in output was less than anticipated. Farm subsidies often encourage environmentally harmful farming, such as the intensive use of fertilizers that runoff into the water supply and, in Europe, the removal of hedges that protect against soil erosion.

6. Note that coupling subsidies to output or acreage means that large, highly profitable, farms get the most subsidy and the small, less profitable farms get only a small amount of subsidy. See Figure 4 where the red line sloping up from the origin shows a typical

FIGURE 1. CONCENTRATION OF USDA FARM SUBSIDY PAYMENTS, 1995–2011



Note: Since 1995, 83 percent on farm subsidy payments have gone to the top 15 percent of farms, while the remaining 85 percent of farms have received only 17 percent of the payments made during this time.

Source: Environmental Working Group, "USDA Subsidy Concentration, 1995–2011," accessed May 15, 2013, <http://farm.ewg.org/progdetail.php?fips=00000&progcode=total&page=conc®ionname=theUnitedStates>.

output subsidy: the more output that is produced the larger the subsidy, which means giving large subsidies to large profitable farms. The blue, downward sloping, line shows a subsidy system that would benefit farms with small outputs and would gradually disappear as the farm's output and profitability increased. Most farms do not receive price supports because only certain crops receive price support – mainly grains, rice, and tobacco. The subsidy system means that the Department of Health was attempting to stop people smoking while the Department of Agriculture was subsidizing farmers to grow tobacco.

7. In the 1990s and 2000s subsidies cost between \$10b and \$30b a year and have averaged about \$20b over the last five years. About 80% of price supports go to the largest 10% of farms. The 1996 "Freedom to Farm" Act was designed to eliminate price supports and most other forms of subsidy over five years and to decouple subsidies from output. A compromise was reached to get votes to pass the Act and it was agreed to subsidize land that produced a crop that had a value of \$1000 in 1981. The subsidy was paid whether the land was used to produce the original subsidized crop or something else, or if it is was used to produce some other crop, or is timbered, or left fallow, or developed). This has led to some very strange outcomes – widows, lawyers and members of Congress receiving checks from USDA just because they occupied land that had once received subsidies.

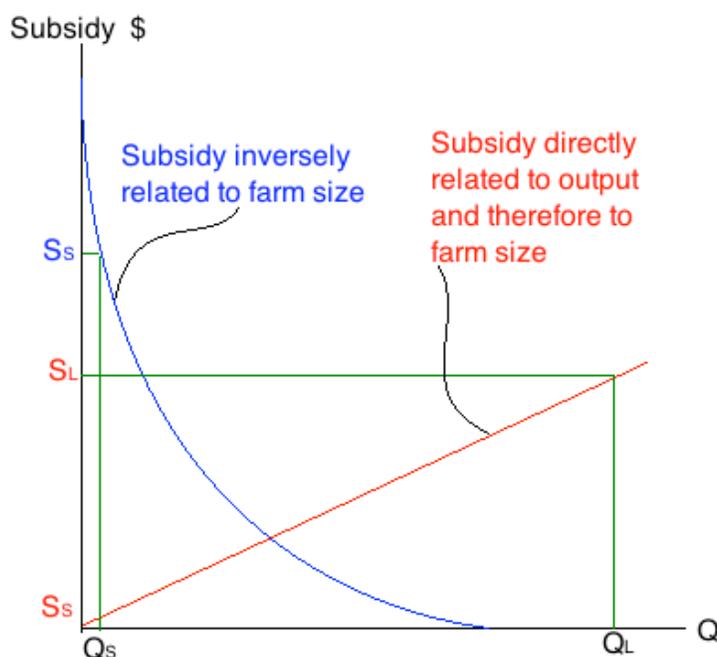
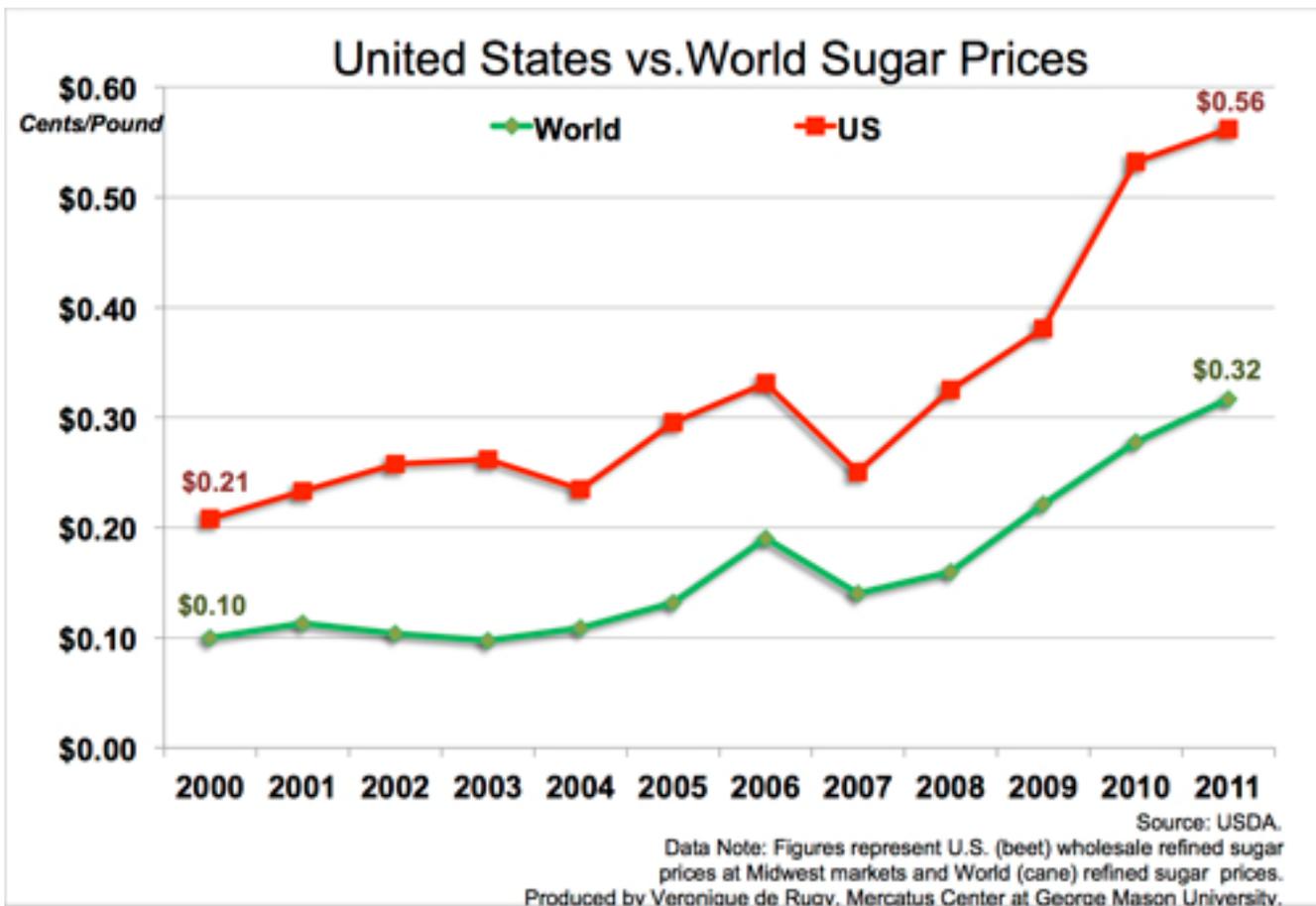


Figure 4

who receive agricultural subsidies although they do no farming. Congress has passed a whole set of laws restoring agricultural subsidies usually on the excuse that there is some agricultural disaster. Disaster payments are paid in some cases just because the farm is located where a disaster is possible that there could be a disaster, not because there has been one, which encourages farming in areas subject to floods and wind damage.

8. Trade protection, for example U.S. sugar quotas, and subsidized exports are major problems for LDCs.



9. New Zealand has a large agricultural sector. New Zealand removed its agricultural subsidies in 1984. After an initial period in which New Zealand farmers struggled to adapt, New Zealand agriculture is now flourishing as it exports mutton and milk to Asia – New Zealand is now referred to as the Saudi Arabia of milk.

10. In the UK subsidies are targeted at preserving the rural landscape – “England’s pastures green” – and the hedgerows that provide a habitat for small animals and birds. Of course it might be cheaper not to farm at all but to keep the fields pristine!

6. THE ECONOMICS OF SUBSIDIES

1. Figure 5 illustrates the standard economic analysis of subsidies – not simply agricultural subsidies. The subsidy increases supply from S to $S_{\text{subsidized}}$. The original supply curve, S , is also the MC curve. At equilibrium, Q^e_s , the consumer pays P^e_s but the producer receives P^e_s plus the subsidy, which is equal to the height of the MC above Q^e_s . Remember that the producer will only produce the Q^e_s unit if it receives at least the cost of producing that last and most costly unit. In other words, MC_s is the firms’ WTA. The firms receive the subsidy on all of the units produced and so the total subsidy is $(MC_s - P^e_s)$ times Q^e_s . The firms receive an increase in Producer Surplus that is equal to the area of the blue trapezoid: the area above the MC curve between P^e_s and P^e_0 . Because consumers are able to consume more units of the good or service

at a lower price, the size of the Consumer Surplus also increases, by the area of the pumpkin colored trapezoid: the area below the MB curve between P^{e_0} and P^{e_s} . However the subsidy (the rectangle from MC_s to Z to X to P^{e_s}) is bigger than the sum of the increased Consumer Surplus and the increased Producer Surplus by the two DWL triangles A and B. At Q^{e_s} $MC > MB$ and so the output is not economically efficient. Each unit produced beyond Q^{e_0} has a $MC > MB$; the difference between MC and MB ($MC - MB$) becomes larger and larger as we move to the right along the positively sloped MC curve and the negatively sloped MB curve. The subsidy makes society worse off although it may make the specific recipients of the gains from the subsidy better off.

2. Removing the subsidy would appear to be a Pareto Improvement because the subsidized output is not an efficient one and the subsidy is more costly than the gains. But such a policy may not be a Pareto Improvement if we take into account the fact that removing the subsidy will harm the producers and consumers of the good or service being subsidized. Taxpayers, who pay the subsidy, are worse off because of the subsidy, but tax payers are a diffuse group whose personal losses (increased taxes) may not be large enough for them to take joint action and they may not even be aware of the fact that they are paying higher taxes to finance the subsidy. On the other hand, as economists love to say, the subsidized producers, and to a lesser extent the subsidized consumers, may gain a lot from the subsidy and may therefore constitute a highly organized pressure group who are able to spend money on lobbyists and make campaign contributions who may be influenced to institute, maintain, or even increase the subsidy.

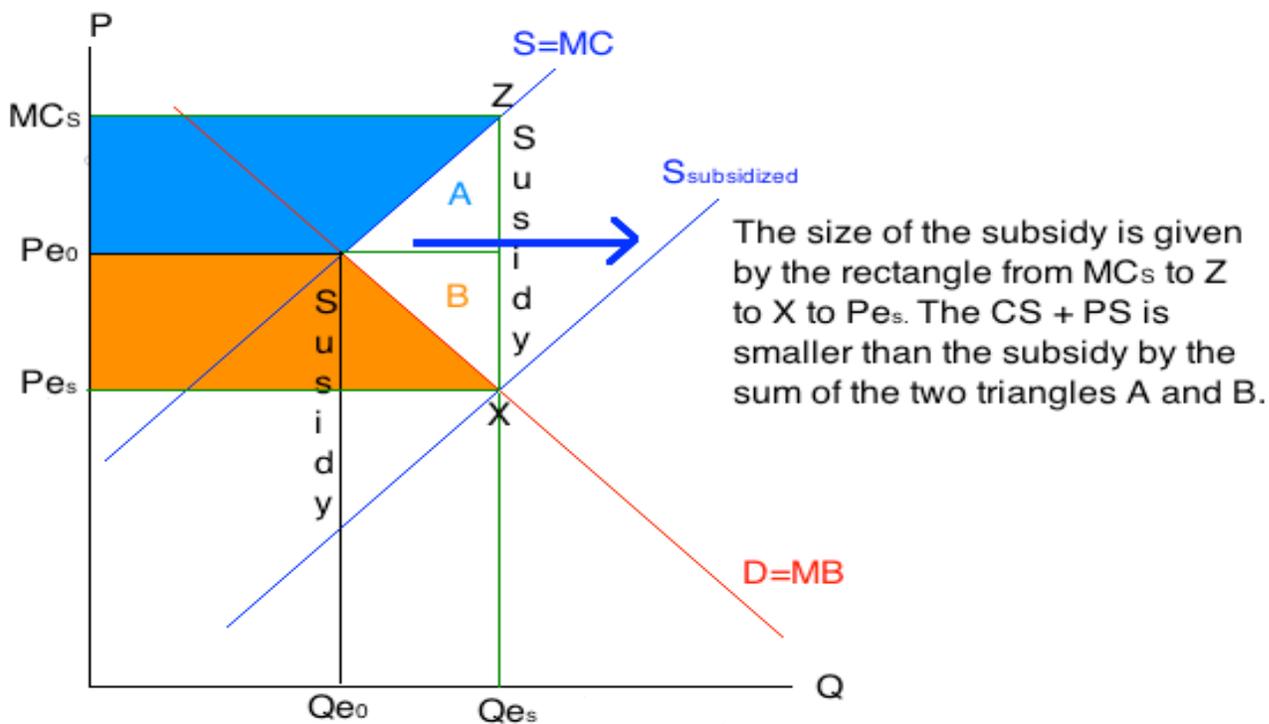


Figure 5

3. Agricultural subsidies are a classic example of “special interest group” problems, where there is a small and well-organized group (farmers) who stand to gain a lot from the subsidy and a large number of largely unorganized losers (taxpayers) whose individual losses are small and who may not even understand that the subsidies harm them.

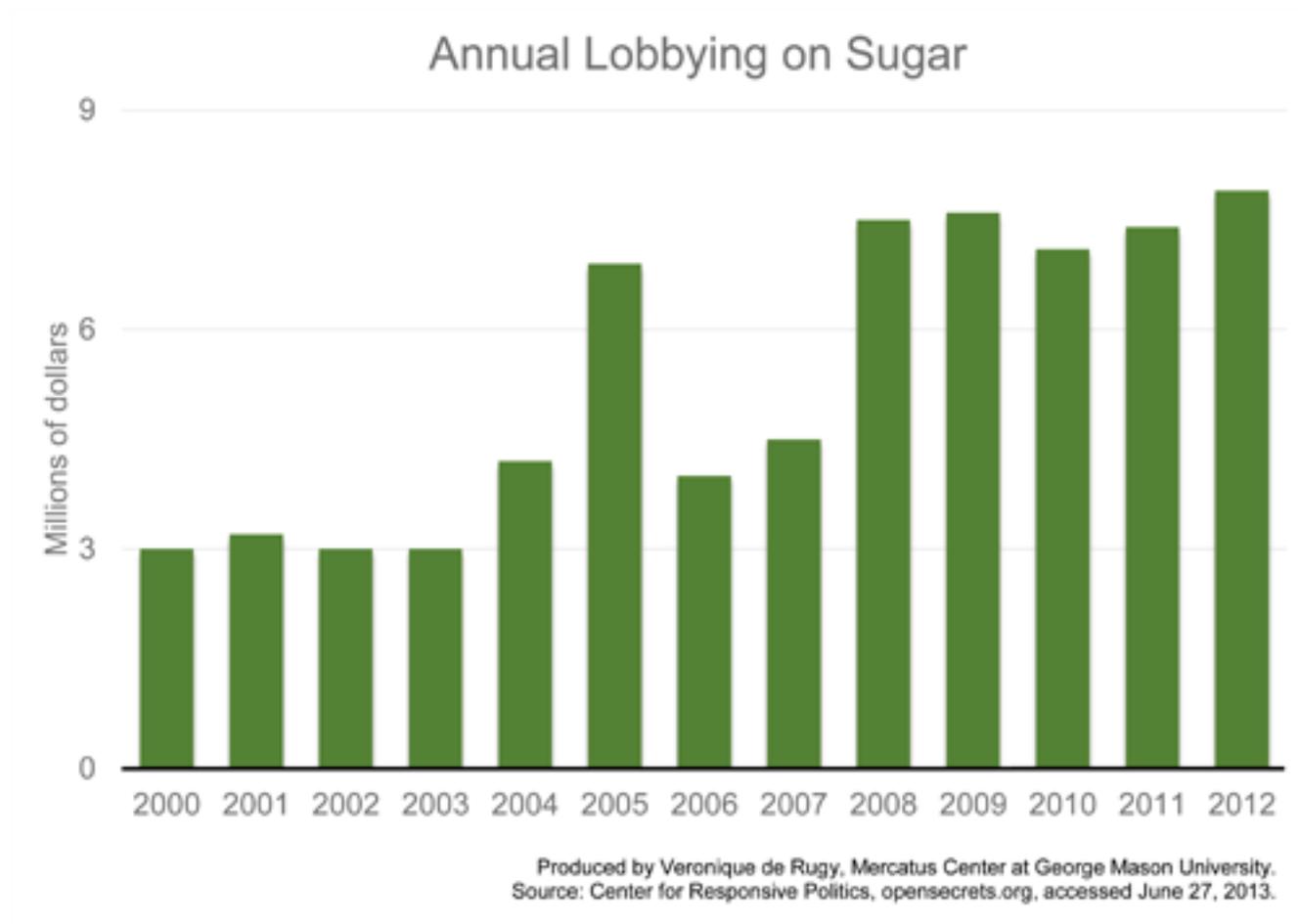
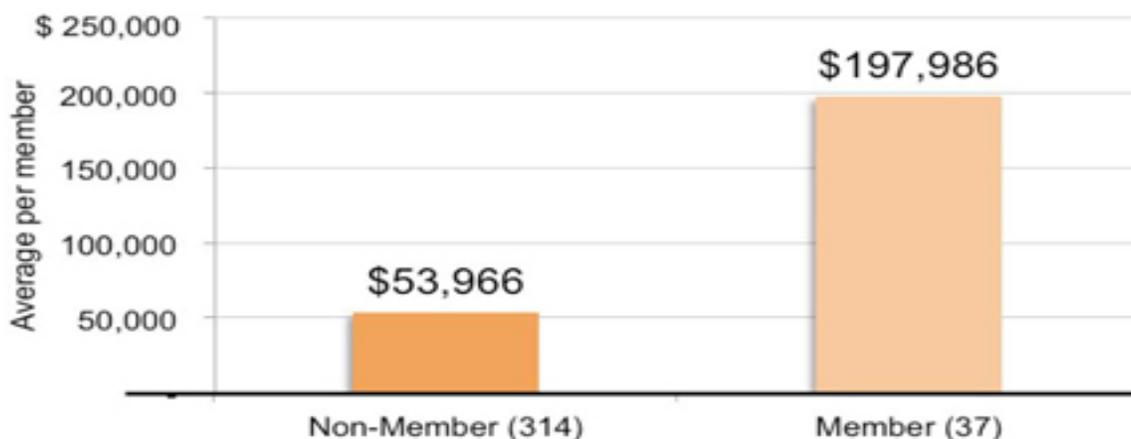


FIGURE 1. AGRIBUSINESS DONATIONS BY HOUSE AGRICULTURE COMMITTEE MEMBERSHIP, 2012



Source: Center for Responsive Politics via www.opensecrets.org, accessed 11/25/2013.
Data note: These figures represent donations from the 2012 election cycle to members of the House Agriculture Committee of the 112th Congress.
Produced by Matthew Mitchell, Mercatus Center at George Mason University.

3. Agriculture is a reasonable approximation to a competitive market: there are a large number of buyers and sellers (especially for agricultural goods that are traded internationally), the buyers and sellers are small relative to the size of the market, the products are homogeneous (each unit is indistinguishable from every other unit), and, most importantly, there is freedom of entry and exit (it is relatively easy to buy and sell farms) in the long run. The initial impact of the agricultural subsidy is to make farms more profitable but the high rates of return lead to predation. The new entrants bid up the price of farm inputs, especially farmland. When a farm is sold the buyer has to pay for the present value of the future subsidies. Farms become more expensive until the rate of return is just sufficient to keep the marginal farm producing the subsidized crop. Only the farmers who were farming when the subsidy was introduced gain, every one else ends up making a normal rate of return on capital. (3,209)

<http://www.choicesmagazine.org/choices-magazine/theme-articles/3rd-quarter-2014/theme-overview-the-2014-farm-bill-an-economic-welfare-disaster-or-triumph>

<http://www.choicesmagazine.org/choices-magazine/theme-articles/3rd-quarter-2014/welfare-effects-of-plc-arc-and-sco>

7. THE RHETORIC OF AMERICAN FARM SUBSIDIES

1. Farmers need a “safety net” to protect them from “dramatic swings in commodity prices and volatile weather” and to “insure an adequate food supply”.

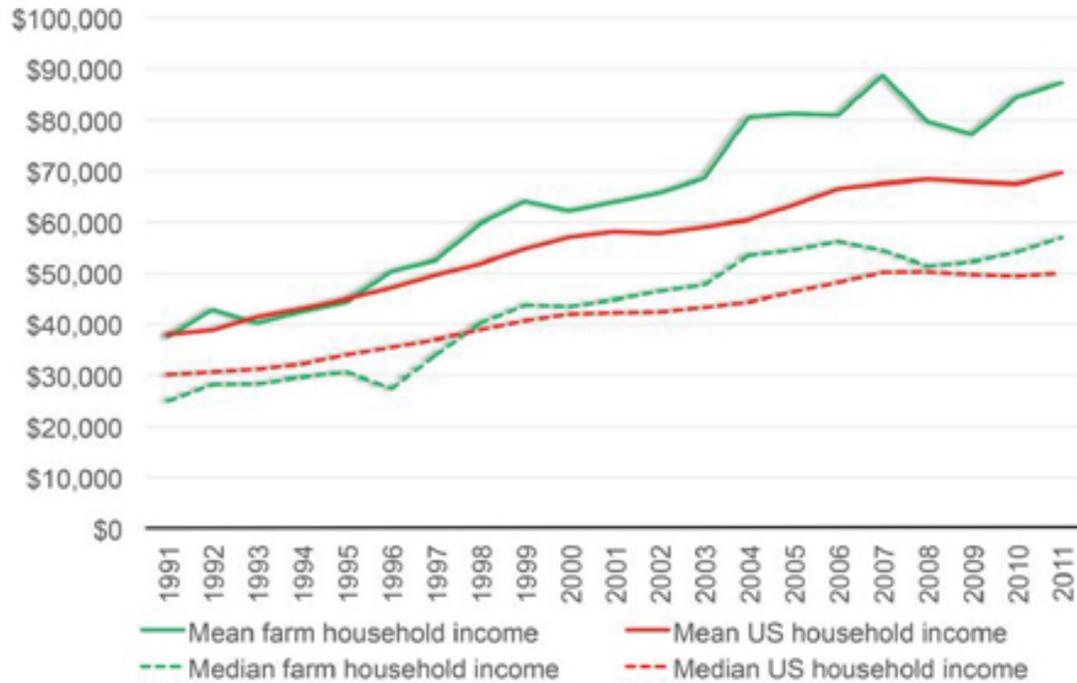
2. Why are subsidies necessary for an industry that has experienced high crop income and record land prices in many years? And if we are in danger of running out of food why has 30% to 40% of U.S. corn production been diverted to produce ethanol while about 50% of U.S. wheat production is exported?

3. The argument for subsidies is based on a number of assumptions. Farms are assumed to be at an unfavorable financial position relative to non-farm small businesses. They are asserted to face more financial leverage and a higher probability of bankruptcy than do non-farm businesses. And farm households are often assumed to have less wealth and lower incomes than other households. And the rhetoric claims that subsidies are needed to save small family farms.

4. In fact family farms are households that are wealthier and have higher incomes than non-farm households. The U.S. Department of Agriculture (USDA) estimates that 98% of U.S. farms to have wealth above the national median level. In 2012, the USDA estimated the median farm household income to be \$68,000, 34% higher than the \$51,000 national median household income.

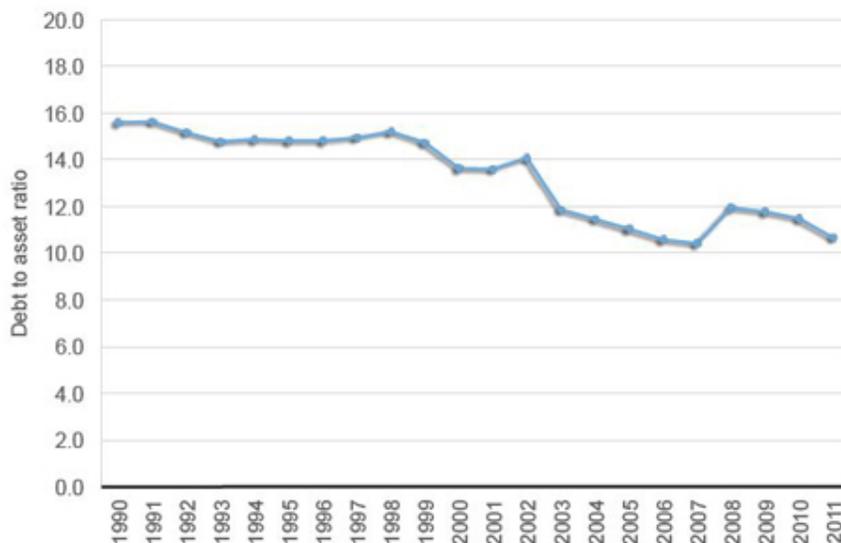
5. U.S. farmers, like other small businesses, depend on borrowed capital. But, the leverage ratio (debts over assets) of farms is less than 10% compared to the average U.S. household’s leverage ratio of about 29% in 2010. In the three years from 2010 and 2013, net farm income increased by two thirds (from \$78 billion to \$130.5 billion). And most of the subsidies go to the largest and most profitable farms not to the “small family farms”: between 1995 and 2012 the top 20% received 89% and the top 1% received 25% of all farm subsidies. (3,705)

FIGURE 2. FARM HOUSEHOLD INCOME VS. US HOUSEHOLD INCOME, 1991–2011



Source: USDA, Economic Research Service, "Median Farm Household Income Forecast Up in 2012 and 2013," accessed May 15, 2013, <http://www.ers.usda.gov/topics/farm-economy/farm-household-well-being/farm-household-income.aspx>.

FIGURE 5. FARM SECTOR DEBT TO ASSET RATIO, 1990–2011



Source: USDA, Economic Research Service, "U.S. and State Farm Income and Wealth Statistics," accessed May 15, 2013, <http://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx>.

