

ASSESSMENT OF THE DANISH SYSTEM ON AGRICULTURAL LEVIES

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Preamble

I have been asked to give my appraisal of the Danish system that levies farmer output and pesticide usage to create funds that can be invested in R&D projects aimed at benefiting that same farmer group. Supporters of the system point to its success in keeping Danish farmers competitive with the rest of the world, with the levy mechanism designed to avoid the free rider problem. Critics say that there is little arms length vetting of the success of the funded projects, and that, as tax money, the pesticide money should be used to further a broader social agenda than simply shoring up the profitability of the farming sector.

My Background

I am a professor at Harvard University where I hold a chair in agriculture and business. I have been on the faculty of Harvard Business School for nearly 40 years and have taught a wide variety of courses including managerial economics, agribusiness, risk management, marketing, retailing and ethics. I currently teach a course on agribusiness to MBAs. I have a BA from Oxford University, and a PhD from MIT.

My opinions derive from reading documents provided to me by the Danish Agriculture and Food Council, and my own research.

Outline

In the first section I describe my general view of issues in agriculture by way of giving context to my more specific remarks on Denmark. I then describe my understanding of how the Danish levy system works as a means of funding R&D. Then I give my appraisal of its merits followed by a more general discussion.

General Background on the Food System

In many countries, perhaps all, society has a special relationship with farming and farmers. Food is obviously an essential product. Current world inventories are sufficient to feed the world for about 60 days, so it is important not to take the industry too much for granted. Countries, and their peoples, understand that controlling one's own food supply makes a lot of sense. Japan currently relies on imported food for 70% of what it eats. I'd say this is a cause for concern.

There are less dramatic reasons to favor a vigorous domestic farm system. Consumers increasingly prefer locally produced food because of considerations of freshness,

and because of concerns about carbon footprints. Farmers are also *de facto* guardians of much of the environment; adding sustainability constraints can only be effective if the underlying industry is profitable.

Critics of farming, like some NGOs, suggest that the industry is dominated by “multinationals” and call it “industrial farming”. This is not true; farming is still mostly conducted by small private operators, often on land handed down through generations. The average farm size in Denmark is 70 hectares. In the US it is about 200 hectares. Large farms in Brazil and Australia can be tens of thousands of hectares. The United States government has made many efforts to help its own farming sector overcome the disadvantages of fragmentation. It set up “land grant” universities in part for the purpose of conducting agricultural research. The US (and Denmark) allows farmer cooperatives to operate as an exception to rules about competition between competitors. The US government used to give subsidies to mitigate price risk and still offers financial support for crop insurance. The Brazilian government funds an influential agriculture research institute called Embrapa. Each of the US, Brazil, Canada and Australia spend about 1% of their agriculture sector GDP on publicly funded agriculture R&D (see World Bank publication 145).

Nations have also instinctively sought to give protection to their farming sectors by placing tariffs and quotas on foreign food imports. One problem with protectionism is that eventually the public rebels against artificially high domestic food prices. Another is that protectionism rewards inefficiency and rarely corrects it. Growing up in the UK, I was witness to the endless subsidies that my country gave to the shipbuilding industry on the grounds that it was strategic for an island state. Eventually the efficiency of foreign competitors made the subsidies untenable.

There is also inherent tension between national protectionism and the larger goal of “feeding the world”. The world can easily feed 9 billion people with current levels of technology and resources. But to do so requires free trade. China, with the world’s largest population has, in recent years, surrendered the notion that it can feed itself, and has turned to the rest of the world for rapidly increasing imports.

There are other opportunities for farmers to make money beyond increasing yields and improving efficiency. A word synonymous with farming is “commodity”. Wheat is an example of a commodity. Though there are different types of wheat, and the final product can be affected by growing conditions and other factors, the distribution system traditionally obliterates these differences because in transit wheat is pooled by distributors. The fact that is treated as a commodity becomes a self-fulfilling prophecy. There is hope however. The desire of Europe to avoid GMOs led to the need for keeping track of where shipments of commodities came from. There is a more general concern about traceability for all commodities: partly this is due to a desire to trace the origin of food if there is a food scare and partly because of a consumer desire to be informed about growing conditions on the originating farm, whether for its use of pesticides, worker treatment or animal welfare.

Another way to combat a commodity tag is through national branding. Whether deserved or not, countries like New Zealand and Denmark have an image of bucolic “greenness”: or at least a lack of industrialization. I grew up eating Danish butter and New Zealand lamb believing both to be the best. If Danish farmers compete with each other over “Danishness” then the ability to capture that extra value is diminished. The point is that though farming is fragmented, there are opportunities for farmers to create value through cooperation. They can cooperate by acting jointly to buy supplies, to sell their products, to fund R&D, or by cooperating on maximizing the value to consumers of Danishness.

Agricultural R&D

R&D has an important role to play in ensuring the success of farmers. A lot of money has been spent improving yields through, for example, improved seeds and the optimal use of fertilizers and pesticides for grain farmers, and nutritious feeds and genetics for animals. Despite the keen desire of farmers everywhere to improve their income, there is little evidence that they can make much difference on their own.

In the United States, as an example, corn yields have risen in more or less a straight line over the last 75 years from 35 bushels per acre in 1940 to 175 bushels per acre in 2015. That’s a five-fold productivity gain. Put another way, without those gains we would need 5 times as much land today to achieve the same total output. The increase represents an average 2% improvement per year. You might suppose that that is not an unreasonable rate of improvement until you consider what the improvement was in the previous 75 years. It was zero. Farmers, left to their own devices, made no improvements in yield for decades. It was science and the use of statistics – agriculture research — that brought about the sudden improvement.

The main advances today are accomplished by profit making companies both large (Syngenta) and small, by universities, by international organizations (e.g. the Consultative Group on International Agricultural Research) and government-funded institutions (Embrapa).

The research done by the larger private organizations is usually designed to help major crops and major geographies, because that’s where the money is. Yet farming is an intensely local matter. Africa, for example, has been largely overlooked because its crops and growing conditions don’t match the US, Europe and Brazil, and it does not have the money to pay for local adaptations. That’s why much R&D is done by smaller, local organizations, or non-profits like CGIAR that try to help yields and nutrition in developing countries.

While the impact of R&D on agriculture has been outstanding that does not necessarily imply that it is a profitable endeavor. However some academic research has looked at this question in a systematic way and has concluded that R&D is very profitable.

Consider the study “Research returns redux: a meta-analysis of the returns to agricultural R&D” published in the year 2000. The authors examined 289 other studies (hence “meta” study) to try and gain a big-picture view of the profitability of agricultural R&D. They report an average return to R&D of (a staggering) 65% per year. They looked at various ways this number could be overly optimistic. They accounted for inflation. They accounted for the possibility that only successful projects were analyzed. And many other possible explanations. Depending on what you account for, the returns vary but they are all large. Their conclusion is supported by a study published by the U.S. Department of Agriculture, “Economic Returns to Public Agricultural Research”, which says, in part, “Economic analysis finds strong and consistent evidence that investment in agricultural research has yielded high returns per dollar spent..... (with a) social return on investment of about 45%”. It continues “as a rough approximation, this implies that each dollar spent on agricultural research returned about \$10 worth of benefits to the economy”.

Can the returns really be that large? Certainly Monsanto does not seem to enjoy those kinds of returns. The difference between research performed for profit and that performed by non-profits is that private companies must try to develop something that is patentable, and their return is calculated only on the price they derive from sales, as opposed to the total farmer (and social) benefit that their products create.

Numerical Example: Suppose I can make a product that has cost me \$1 million to invent and costs \$4 to produce. Let’s say that to a farmer this product is worth \$10 in yield improvements. I decide to sell the product for \$6. Suppose I manage to get 40% of a total of 100,000 farmers to buy my product. So I make $40,000 \times \$2 = \$80,000$ or a return of 8% on my investment. But in addition each of the 40,000 farmers gains \$4 in profit for a total gain of $40,000 \times \$4 = \$160,000$ in productivity. So the total value created by the innovation, both to me and to the farmers who use my product, is \$240,000 for a 24% societal return per year. But we can do even better if the research is done with public money. Suppose the product is made available to all farmers at the production cost of \$4, the added value will now be $100,000 \times \$6 = \$600,000$ for a societal return of 60%.

So if the returns are this high, why don’t farmers invest more in R&D? There are many answers. One is that a farmer, or farmers collectively, will not see all of the benefits. Some accrue to others: for example higher milk production is good for the farmer but also is good for the cheese producer, and the pizza maker. A second is that the benefits accrue over time: the people responsible for yield improvements in 1940 never saw all of the benefits they created.

Finally, and crucially, research done by one farmer rarely results in a protectable competitive advantage for that farmer alone. This is why R&D in farming is better done as a collective exercise. Yet implementing a collective R&D investment fund is easier said than done. If farmers cooperate to buy supplies more cheaply, the benefit of lower prices flows only to those involved. The situation is quite different if farmers cooperate to fund R&D however, because the output of the research, especially if the results are announced in a public forum, is available to all. So if some farmers, but

not all, cooperate voluntarily to pay for R&D, the non-contributing farmers can free ride by benefiting from the R&D without paying. Perhaps the cooperating farmers could try to prevent the non-paying farmers from learning of the results, or of profiting from them, but then the complexity of the operation starts to spiral out of control. Farmers start to defect because of the unfairness and pretty soon you have no R&D at all.

Why don't governments invest more in R&D? The reality is that governments, like companies, tend to prefer investments whose benefits can be seen quickly. But returns of 45-65% per year are hard to ignore. It would be wonderful if there were some kind of institutional arrangement that encouraged (required) private companies (farmers) and government (the agriculture ministry) to invest in R&D year after year, in a way that ensured the funding could not easily be diverted.

Fortunately, in Denmark, you have such a system.

Agriculture in Denmark

Agriculture has an important role to play in the Danish economy (an industry GDP of \$12 billion or 4% of total GDP), in its way of life (172,000 workers), and as a guardian of the environment (61% of the land is cultivated). Denmark also relies on food exports to sustain the economy. Denmark's agriculture sector exports two-thirds of its production, which is responsible for 25% of all exported goods.

Clearly whatever you have been doing to achieve these results deserves congratulation. It is evident from an article by Jesper Løvenbalk Hansen ("From Famine to Food Mecca") that the actions of government have played a major role in that success. Referring to the "poverty and misery that afflicted the country" in the 1800s, Hansen recounts that "The government of the day vowed that never again would Denmark go hungry, and set in motion the work of developing the country and especially its agriculture through massive investment in education and research". And it worked; by the end of the 1800s Denmark was self sufficient in food production.

There is no risk that Denmark will cease to be self-sufficient any time soon. But complacency is dangerous. While agriculture has always been a fairly sleepy, slowly changing industry, things now are changing at a more quickly, driven by technology changes, and an increasingly vocal consumer. Countries like Brazil, China and the Ukraine are professionalizing their agriculture sectors at a rapid rate. Denmark has a long history of supporting the cooperative movement that has allowed the farming sector to compete on a professional level with these other countries despite Denmark's small size. The recipe for maintaining this position is likely more of the same, not less.

On top of these global production changes, global consumer tastes are changing rapidly and becoming more influential. (I read this morning that Denmark is considering taxing beef as a contribution to controlling climate change.) In a fast changing industry, innovation becomes increasingly important. You have a fragmented industry in an

expensive part of the world. It makes sense that R&D spending should be a priority to maintain competitiveness.

The Danish Levy System

An important part of the national R&D investment comes from the levy system. Many years ago farmers collectively decided to impose a levy on their own production in order to fund R&D projects that would help their industry. To avoid the free rider problem, and with the cooperation of government, the money is a statutory levy collected by the distributors and slaughterhouses that buy the farmers' products. This money is then paid into about 11 funds, called the Commodity Levy Funds, which actually do the investing. There are 11 funds because money paid by pig farmers is paid into the "Pig Production Levy Fund" which is used to invest money in R&D projects that are likely to help pig farming. Similarly, the levy on potatoes goes into the Potato Production Levy Fund. Each fund is managed by a group of people appointed by the Minister of Environment and Food. By agreement, a majority of each board is appointed in consultation with the relevant farmer group, and as a matter of practice, these are farmers who pay into the fund. The minority board members are appointed to represent the public interest and are from all walks of life. It is important to note that the role of these boards is not only to decide how the funds should be invested, but also to recommend to the minister what the levy rates should be, and, if appropriate, that the fund should be abolished. Notably they have yet to take that step, a clear indication that farmers support the levy funds. Taken together these funds raise and invest about \$37 million.

In 1978 a land tax was introduced with a view to raising money to reduce the burden of the commodity levies. Part but not all of the money raised was to be used to finance three more levy funds, called the Agriculture Development Fund, The Fund for Fruit Cultivation and Horticulture, and since 2001, the Fund for Organic Farming. The R&D money was not to be tied to a particular agriculture sector, but could be used to benefit the sector more generally. The basis for this tax was later switched from land to pesticides, with a view to helping the environment, and these three funds are now known as Pesticide Levy Funds. Here too, the Minister appoints the boards, a majority is appointed on the advice of farming groups, and they may vote to abolish the fund. The pesticide levy funds spend about \$38 million per year.

Each board solicits research proposals, votes to allocate the available money and evaluates the benefits derived from the invested funds. The National Audit Office monitors the process.

Evaluation of the levy system

It seems to me the levy system is (i) a good thing for Denmark and (ii) it is working well. I base the conclusion that the levy system is a good thing on these observations:

1. As I have mentioned, agricultural R&D is a very good investment for farmers and for society at large. In general, the more the better.

2. There is a natural tendency for farmers and governments, absent a forcing method like the levy system, to underfund R&D. The commodity levy system encourages farmers voluntarily and collectively to fund the future of their industry. I think it is fair to assume that if the commodity levy system were to disappear, farmers would not spend the same amount, and not as effectively. The pesticide levy is government voluntarily choosing to fund the future of an important industry that supports a significant element of the economy.
3. In short you have a collaborative social system by which money is contributed to fund R&D projects that would not otherwise take place. A lot of the success of the Danish agricultural sector is due to the success of the cooperatives; the levy system is, essentially, an R&D cooperative.

I base my assessment that the system is working well on the following:

1. I like the fact that it is farmers who have a key role in choosing how the money is spent. Government sponsored research money is often allocated by government officials who are often not close enough to the real issues to be effective. Large institutions and universities can (and should) work on problems to benefit the world; Danish farmers are best placed to understand what needs to be done to help Danish farmers be competitive.
2. I think it useful to have some voices on each board that have expertise on the environment, sustainability and more generally, consumer trends, because these are important emerging directions for agriculture.
3. So far as I can tell, farmers in general seem happy with the levy system, and by inference, with its performance. They have every reason to make sure that the money is not wasted and in fact that it is spent wisely.
4. So far as I can tell, the government is happy with the system. The main overseer of the levy system is the Minister of Environment and Food, part of a democratically elected government, who appoints the boards that govern the process and who, moreover, has expressed his support for the system, as indeed have the majority of his predecessors, some from other political parties.
5. The public nature of the levy investment process, in part due to the presence of non-farmer board members, creates transparency, enabling all to be informed of its workings and accomplishments and to make their own judgments about its effectiveness.

The key thing to recognize is that you have an R&D system that ensures that overall investment level in the agriculture industry is kept at a sufficient level to maintain the industry's current impressive competitiveness. The current spending level is by no means excessive.

Could the levy system be improved? I wonder, for example, if the process is a bit too bureaucratic. There are in the 14 funds about 140 board members discussing how to invest \$75 million per year, or about \$500,000 per person. Involving so many people has many positives, but I wonder if fewer people might be more engaged in the process and feel more individual responsibility for the outcome. I think it might help if the purpose of the funds were clearer. While debate on the use of public funds is desirable and appropriate, the question is, when should that debate occur? The government currently decides on an amount of the overall pesticide levy money to transfer to the R&D funds, and the rest goes to other causes. I would suggest that this might be a better moment to decide how much money is to be allocated to support the industry, and how much is allocated to finance other causes.

But all in all, I would leave well enough alone. You have a system that is working.

Discussion

In western democracies society (government) sets the rules by which individuals and organizations operate (the law) and then individuals and companies maximize their own welfare within those rules. If Danish farmers were to merge and become one financial entity no one would question their right to fund research at whatever level they chose. Society would also be within its rights to put whatever constraints on farming practices that it felt appropriate, like banning GMOs, or establishing standards for animal welfare.

These two roles, societal and private, have become somewhat confounded in the Danish levy system. The problem arises because one method of levy funding involves a government-imposed tax on farmers (the pesticide levy).

The main benefit of a government-sanctioned levy is to avoid the free rider problem. This is presumably why a majority of Danish farmers support the system. A tax imposed by the government is legally enforceable.

This support of the levy system is one of the roles of government. Governments tax their people to pay for activities that the people on their own might not be capable of providing. Infrastructure like roads and bridges might get built with private funds, but obtaining rights of way, and charging users can be very difficult to implement. So government pays for the infrastructure out of taxes. Not everyone gets the same benefit from the infrastructure but the social benefit of common action outweighs any disparity in benefit.

If the levy funds were to be abolished would there be any harm? The farmer trade associations could collect fees from their members to fund the R&D and leave the government out of it. The government could use its own funds to set up a research laboratory to conduct R&D. A private company could be formed to take over these activities, for profit. Each of these ideas is imperfect and comes with risks, but right

now you have a system that appears to be working well, with a democratic solution for those who disagree.

In 2015 the minister (Dan Jørgensen, Social Democrats), speaking in parliament, said as follows (my translation from Ministry for Food, Agriculture and Fisheries 2015):

I am proud that the Danish food cluster is one of the world's strongest, and it must continue to be so. We need to give it our support and help develop it. We know the industry has many challenges that need to be solved. New knowledge, new solutions and new business models are essential for its success, and the agricultural funds must continue to be key players in finding these solutions.

I agree. The levy system has likely played an important role in making Danish agriculture competitive. It would be unwise, in my view, to upset the coalition of farmers and government interests that keep it going.

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