Government intervention in green industries: lessons from the wind turbine and the organic food industries in Denmark

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Abstract Government intervention in green infant industries may be justified as a strategy to increase the provision of public goods. How should government policies be designed to promote such industries? One way to analyse this question is to compare government intervention in green infant industries in which it has been successful with green infant industries in which it has been less successful. The Danish government has intervened intensively in the wind turbine industry and organic farming sector mainly for environmental reasons since 1992 and 1987, respectively, but with very different impacts. While the electricity market share of wind energy reached 20% in 2007, organic food consumption lags behind with a food market share of approximately 8.5% in 2007. This paper compares the packages of policy instruments applied in the two industrial sectors and assesses whether differences in instrument choice may explain the significant differences in market shares. It is demonstrated that government intervention in the wind turbine industry has emphasized the use of policy instruments designed to increase demand for wind energy, whereas organic farming policy has put more emphasis on instruments motivating farmers to increase supply. This may be an important factor explaining variance in growth. Finally, the paper analyses whether the lessons from government policy aimed at promoting the wind turbine industry can be transferred to organic farming policy.

Keywords Policy instruments · Policy impact · Public goods · Wind energy · Organic farming · Infant industries

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1 Introduction

Governments have engaged in the promotion of green industries for quite some time. For instance, they have provided regulatory frameworks facilitating growth of particular green industries and sponsored growth directly by providing various types of subsidies. These experiences in green industry promotion may be valuable in government efforts to combat global warming, for example. Government intervention to promote green industries is often legitimized by public good provision in terms of better environmental quality.

A *public good* is traditionally defined by two conditions. First, *non-excludability*, which means that exclusion from benefiting from the good is not feasible. Exclusion does not have to be technically impossible, only uneconomical. Second, *jointness of supply*, that is, making a good available to one individual means that it will be supplied to others as well. There is no crowding effect. The abatement of global warming is one example of a pure public good because it fulfils both conditions. It is not possible to exclude anyone from enjoying the benefits of avoiding the greenhouse effect, and this abatement is independent from the number of people benefiting from it. So, no matter the size of the world population, everybody will benefit from avoiding a global catastrophe. Biological diversity, e.g. protecting the rainforest and international security, is another example.

David Hume was the first to treat the public good provision problem in an academic way. In his *A Treatise of Human Nature* (1739 [1984]), he wrote that two farmers can cooperate in draining a swamp they own in common but one thousand farmers cannot. Why is it more difficult for the large group of thousand farmers to provide the public good? Hume observed that 'it being difficult for them to concert so complicated a design, and still more difficult for them to execute it; while each seeks a pretext to free himself of the trouble and expense, and would lay the whole burden on others' (ibid.).

In the line of Hume, Olson (1965) developed his 'logic of collective action' arguing that self-regulation is hampered by the members' propensity to free-ride. The larger the group, the stronger becomes the incentive to free-ride. In the case of the one thousand farmers, the individual farmer will avoid paying and then try to benefit from the others draining the swamp or providing any other public good such as reducing pollution. As Olson states it, 'rational, self-interested individuals will not act to achieve their common or group interests. Those who do not pay for a collective good cannot be excluded (from consuming it)' (1965, p. 2). Even when the aggregate gains to a group from attaining a collective good greatly exceed the total costs of that action, it does not follow that the action will occur: individual rationality does not necessarily lead to collective rationality. In this way, the 'invisible hand' fails for larger groups (ibid.). Olson's theory of collective action has been called '*the* central subject of political science' (Ostrom 1998, p. 1). It simply highlights the need for government intervention to solve the free-rider problem when providing public goods for larger groups.

Therefore, governments often have a role to play in promoting public good provision such as those provided by green industries. In practice, governments can optimize their political decisions by undertaking a comprehensive cost-benefit analysis at the macro level. An efficient policy is simply one that maximizes net benefits by providing the optimal level of a given public good. This happens when the net gain, i.e. the difference between the total benefits and the total cost from providing the public good of better environmental quality, is maximized (Tietenberg and Lewis 2009). Thus, the role of government as a public good provider is highlighted in the following.

Governments have, in various ways and with varying effects, intervened in the economy to promote green industries and better environmental quality. In this paper, we undertake an explorative analysis of government intervention in two Danish green industries: wind

power energy and organic farming. In an international comparison, these two industries have been very successful. However, government intervention has been significantly more successful in the wind energy sector than in the organic farming industry. While the organic farming sector, despite recent rapid growth, is of relatively limited size, the wind turbine energy sector has grown rapidly and now produces a fifth of the electricity consumed in Denmark. In terms of its share of total agricultural production, organic farming is still a minor sector within the farming industry.

This paper compares the Danish government's engagement in these two green industries focusing particularly on the packages of policy instruments applied and it assesses whether differences in instrument choice may explain the significant differences in market shares. We also assess whether lessons from the successful wind turbine energy sector may be transferred to the organic sector. While our findings relate to Danish experiences, they do have broader appeal because they can provide lessons for policy makers in other countries attempting to promote green infant industries.

2 Comparing market shares of wind power and organic food

Lundqvist (1996, 16) suggests that environmental policy can be delineated functionally, institutionally or by its purpose. A functional definition of environmental policy includes all public policies affecting the environment negatively and positively. The institutional approach includes in the definition of environmental policy all policies administered by an environmental authority, implying that environmental policy programmes administered by other authorities would not be included though their primary purpose may be environmental. When environmental policy is defined by its purpose, the definition includes policies directed at the environmental problem they are intended to address. In this article, we apply the last-mentioned definition and compare two policies directed at two well-defined policy problems—increasing the production and consumption of wind energy and organic food.

Though wind energy and organic food are not similar products, the two sectors share some characteristics which make them suitable for a comparison of the impact of government intervention. There is considerable variation in the growth of the two sectors, and the question is whether this can be attributed to variation in policy strategies. However, as Lijphart, (1971, p. 683) points out, 'one cannot be sure that a relationship is a true one unless the influence of other variables is controlled.' Fortunately, we can keep constant three important contextual factors and industry characteristics and rule them out as alternative explanations of variation in growth.

First, both these green industries are engaged by the government to produce public goods. When wind power replaces fossil fuels, the risk of global warming is reduced and other public goods, such as less acid rain, smog and particulates, are provided as well. The organic sector also provides public goods in terms of better environmental quality. As Sønderskov (2009) writes, organic food production generally helps improve the environment. Fewer pesticides, for example, help preserve groundwater and biodiversity, and organic livestock production is often associated with better animal welfare. Organic food production also offers a whole range of low-cost options for reducing greenhouse gas emissions (Olesen et al. 2010). Thus, both green industries play an important role for mitigating climate change. Interestingly, the Danish government has engaged in promotion of both industries, but as we shall see by different means.

Second, the two industries emerged in Denmark in the 1970s and thus, have had approximately the same period of time to mature, but have done so to different degrees.

The oil price shock in 1973 revived the interest in wind turbines as a means to produce electricity 'in a way that was independent of oil and that avoided dependence on supplies of raw materials from outside the country' (Tranæs 2001). The establishment of the organic farming movement was associated with the rise of the environmental movement in the late 1960s and early 1970s. The first organic farms were established by urban people who moved to the countryside to experiment with alternative farming and a new way of life 'as a reaction to post-war industrial society and its foundation on material values' (Ingemann 2006, p. 9).

Third, the two sectors have large start-up costs which may inhibit growth. Government intervention can overcome these obstacles. Starting up wind energy production requires major initial capital investments, and therefore the cost of borrowing plays a major role. Lowering the cost of capital can bring down the average cost of energy per unit and reduce the risk of investment. Favourable pricing systems, where well implemented, have provided increased predictability and consistency in markets, which in turn has encouraged banks and other financial institutions to provide the capital required for investment. Thus, government policies have lowered capital cost and increased investment in technology, advanced learning and experience, and produced economies of scale that in turn have led to significant cost reductions (Sawin 2004). In the organic sector, the start-up costs are mainly associated with the costs of conversion. Farmers are obliged to comply with organic farming rules from day one of entering the scheme while they cannot sell their produce as organic until year three. Converting to organic farming is most often associated with decrease in yields and higher production costs, but these costs cannot be retrieved until after full conversion has taken place through the expected price premiums for organic produce. Relying on conversion costs being retrieved in the future involves a risk because it is uncertain what the actual conversion costs will amount to and what price premiums can be expected. In a true market economy with no state intervention in the organic sector, farmers on the one hand or processors and retailers on the other would have to bear the costs of transition or share them. If processors and retailers agree to bear some, or all, of the conversion costs by signing multi-year contracts with farmers, they too would face a risk in terms of uncertainty on future demand and future price level. Government subsidies can overcome the reluctance of risk-adverse farmers, processors and retailers by lowering conversion costs.

So, in both sectors, a key challenge for government was to design policy packages which would motivate market actors to invest in new production technologies to increase the provision of public goods provision, i.e. a cleaner environment. While the Danish government engaged intensively in both sectors, it was with different results.

Looking at market shares, the share of wind-produced electricity in total electricity consumption has grown steadily from about 5% in 1997 to 20% in 2007 (see Fig. 1).

In comparison, the organic sector has performed less successfully. The growth rate has been much lower. Relatively speaking, the market share is approximately a third of that of the wind power. Since the growth of both sectors has been government-sponsored, it is very relevant to compare the policy measures introduced in the two sectors and assess what combinations of policy instruments are the most effective in providing the desired outcomes.

3 Policy strategies in infant industries

Public policies usually consist of a mix of several policy instruments; only rarely do policies rely on a single instrument to sustain a preferred situation or bring about change. The more interventionist the policies are, the more likely they are to rely on a *mix* of

Fig. 1 Market shares of organic products and wind power. *Note:* The organic market share reported is the share of total turnover in the food market for food products for which an organic alternative is available. *Source:* Livijn (2008), Økologisk Landsforening (2007) and own calculations

instruments. Thus, policy is defined by the combination of policy instruments, and therefore, it is important to establish how ‘various policy instruments ... [are] packaged into overall programmes or comprehensive policies’ (Vedung 1998, p. 39).

Since the policy instruments designed to promote an infant industry are specific to the industry, a comparison between government engagement in two or more infant industries needs to be based on a comparison of the instrument *types* used rather than specific instruments. Though some similar types of instruments are applied, it does not make sense to compare their specific settings. What we need to focus on is whether different policy instrument types and instrument mixes are applied in the industries to be compared.

When intervening in an infant industry, governments have a number of instruments at their disposal. Table 1 suggests a typology with four instrument types for infant industry promotion. The typology distinguishes between supply-side and demand-side policy instruments. Supply-side policy instruments are, directly or indirectly, aimed at increasing the supply of the new product through the creation of incentives to produce it. Demand-side instruments are, directly or indirectly, aimed at motivating, or even obliging, consumers to purchase the new product.

Table 1 Policy instrument typology

Supply-side policy instruments (push)		Demand-side policy instruments (pull)	
Direct	Indirect	Direct	Indirect
Examples	Examples	Examples	Examples
Producer subsidies	Funding of research and development activities	Compulsory purchase	Market facilitation
		Consumer subsidies	Support for marketing

Source: An earlier version of this typology was presented in Daugbjerg and Sønderskov (2009)

Where demand effects are seen as the driving force of infant industry growth, policy would aim at creating, or motivating, new demand. By contrast, where supply of new products is seen as the main driving force, policy is designed to motivate increased supply. In practice, infant industry promotion policies may, to varying extents, apply all four types of policy instruments, but the underlying belief on the relationship between supply, demand and industry growth determines the balance of instrument types applied. Thus, it makes analytical sense to imagine a policy continuum running from pure supply-side policy (push) to pure demand-side policy (pull). Which of the two policy strategies is the more effective cannot be established theoretically, but must be verified in an explorative comparative analysis of two or more policy sectors in which the strategies have been applied.

Having ruled out some contextual factors and industry characteristics as explanations for variation in growth in the wind energy and organic food industries, the key question is whether this variance can be put down to differences in the policies directly applied in the two sectors. This cannot be established theoretically, but most rely on empirical analysis. When undertaking such an analysis, one must keep in mind that industry growth can also be affected indirectly by other policies. For instance, taxation of polluting inputs or emissions in existing industries can manipulate the competitive relationship between a polluting and a new green industry as depicted by the switch point theory (Tietenberg and Lewis 2009).

4 Wind power sector

4.1 Government intervention

The key instrument of the Danish government's wind energy promotion policy is based upon direct demand-side instruments. Energy utilities are obliged to buy wind energy at a price above fossil fuel energy, and in the end the extra costs of wind energy is *paid by all electricity consumers*. On the electricity bill, a special tariff called the PSO (Public Service Obligations) tariff is charged (estimated in Sect. 4.2). The technical term for this price support scheme is 'feed-in tariff'. There are two reasons for this term. First, producers of the renewable energy, in this case wind energy, are guaranteed access to the power grid and are thus permitted to 'feed' the electricity they produce into the system. Second, the regulation obliges the utilities to purchase the wind electricity from wind turbine owners at a guaranteed minimum price (Nielsen 2005). Overall, the existing wind turbines in Denmark can be separated into two categories according to instrument setting. Different settings apply to wind turbines built before and after 1 January 2003.

Three main features characterize the price support scheme for wind turbines built *before 1 January 2003*. First, the turbines receive 0.33 DKK/kWh for the first 22,000 full-load hours and nothing after this limit. Full-load hours are defined as the annual wind turbine production in kWh divided by the installed effect. The installed effect is again defined by type approval of the wind turbine. If, for example, a wind turbine produces 1,200,000 kWh per year with a 600 kWh type approval, then it runs 2,000 full-load hours. A land-based wind turbine typically produces 22,000 full-load hours over about 10 years and has an expected production life of 20 years (Energistyrelsen 2001, pp. 5–6, 10).

The 0.33 DKK/kWh price consists of the electricity market price and a supplement to reach this number. If, for example, the market price for electricity is 0.25 DKK/kWh, the turbine will receive an extra 0.08 DKK/kWh, in total 0.33 DKK/kWh. This means that the

price support costs associated with the price support system applied decrease when the electricity market price increases.

Second, turbines built before 2003 typically receive 0.17 DKK/kWh in a number of full-load hours depending on the size of the turbine. Third, an extra 0.10 DKK/kWh price support is given during the first 10 years or a guaranteed number of full-load hours (Moesgaard 2006).

For wind turbines built *after 1 January 2003*, price support is no longer dependent on market terms. A 0.10 DKK/kWh feed-in tariff is now introduced. It was, however, first deducted in the market price during 2003–2004 when the electricity market price increased from 0.26 DKK to 0.36 DKK/kWh. Therefore, the rules were soon modified so that for turbines after 2004, the 0.10 DKK/kWh feed-in tariff is fixed and no longer dependent on the electricity market price (*ibid.*). As the saying goes, today each kWh produced by wind turbines has a ‘dime tied to its tale’ (in DKK).

Overall, wind turbines built before 2003 have been guaranteed a minimum price for the energy produced, whereas wind turbines built after 2003 produce based on the market price. However, they receive a fixed 0.10 DKK/kWh feed-in tariff after 2004 independent of the market price.

In June 2008, a new energy policy concerning new rules for wind turbines was introduced in Denmark. Wind turbines producing electricity after 21 February 2008 now receive more support as the feed-in tariff increased from the former 0.10 DKK/kWh to 0.25 DKK/kWh for the first 22,000 full-load hours (Folketinget 2008). In other words, the dime tied to the tale of one kWh produced by a wind turbine has grown to a quarter (in DKK).

Overall, wind energy development in Denmark has been driven by the government-sponsored demand-side policy of the pricing law. This observation confirms the general pattern of government intervention within the sector. Reviewing policy lessons around the world, Sawin (2004) concludes that the pricing law has had the greatest impact as it ends uncertainties regarding whether producers could sell their electricity into the grid and at what price, and provided investor confidence, making it easier for even small producers to obtain bank loans, and drawing money into the industries.

4.2 The costs of Danish wind energy policy

Because the electricity price has varied substantially over time, the historical PSO costs in relation to the existing wind turbines have varied a lot. Up till 2004, the PSO costs have decreased when the electricity price increased and vice versa. From 2001 to 2006, the variation spanned between 2.2 and 4.3 billion DKK/year (Klima-og Energiministeriet 2008).

From 2006, separate data exist for total price support costs including both running costs and construction costs. This total amounted to 1.7 billion DKK in 2006, and no data exist at the moment for 2007 and 2008 (Energistyrelsen 2008). To our knowledge, separate and annual data for price support costs to wind turbines in Denmark are not available for the period before 2005. Therefore, we asked the Danish Energy Authority (Energistyrelsen) to estimate the magnitude of the price support for our project, which they kindly did. Fig. 2 shows the development in running costs to the wind turbine sector from 1997 to 2005.

The overall result is that from 1997 to 2005, the total annual value of the price support scheme increased by 67% (from 522 million DKK to 1,591 million DKK). After 2000, there is some uncertainty and stagnation in the market due to different political signals concerning government support schemes. The annual support is expected to increase substantially after the new 2008 energy policy proposal in Denmark, however. Calculations have shown that it will lead to an extra annual cost of 0.036 DKK/kWh, i.e.

Fig. 2 Annual costs of price support in the wind sector in Denmark, 1997–2005 (mill. DKK). *Source:* Energistyrelsen (2008). Estimated data for this paper

150 DKK per household (Klima-og Energiministeriet 2008). Note again that electricity consumers cannot avoid paying PSO, which fund the price support schemes for the wind turbine sector.

Furthermore, the wind turbine sector is supported indirectly by environmental taxation which penalizes the use of fossil fuels. There is, in general, a high level of energy taxation in the EU compared to the rest of the world (OECD 2002). Taxation of fossil fuels combined with the price support scheme for producers of renewable energy encourages an earlier switch point in time. In essence, the energy tax changes the price relationship between fossil fuel-based energy production and renewable energy. This, in turn, affects the demand structure in favour of the latter. Denmark started mixing taxation of fossil fuels and subsidization of renewable energy in 1984. Nielsen (2005, p. 117) observes that in 1984, the Ministry of Taxation introduced a general per-kWh electricity tax on electricity consumption from which renewable energy was exempted. In 2005, the fossil fuel tax in Denmark was about 52 DKK/GJ corresponding to 0.19 DKK/kWh. At the same time, for purposes of supporting renewable technologies, a per-kWh price support scheme for producers of renewable energy was installed (*ibid.*).

5 Organic sector

5.1 Government intervention

Denmark was the first country to enact a distinct law on organic farming (1987). From the start, it applied both supply-side and demand-side instruments. As to the former instrument type, it introduced direct farm subsidies to ease conversion from conventional to organic farming for the first three years of the conversion period. In 1989, additional conversion payments for organic livestock were introduced.

As a consequence of implementation of EC Regulation 2078/93, permanent subsidies for organic farming were introduced in 1994 (see Table 2). This scheme provided conversion subsidies, based on area, for *two* years and permanent organic subsidies. To be eligible, farmers had to farm organically for at least five years.

To increase the supply of organic arable products and pig meat, the subsidy scheme was altered in 1996. Additional support was provided to organic farms without milk quotas and a special subsidy to pig producers was also introduced (Strukturdirektoratet 1999, p. 136). Table 3.

Table 2 Danish organic area payments, 1994–1997 (DKK per hectare)

Year	1994	1995	1996
Conversion payment	300	275	200
Permanent organic payments	750	600	450
Payment for reduced fertiliser use	650	525	400
Supplement for environmentally sensitive areas	215	215	215

Source: Bekendtgørelse no. 250 (1994)

Table 3 Danish organic area payments, 1997–2003 (DKK per hectare)

Year of five year obligation period	1	2	3	4	5
Permanent organic payments ^{d,f}	600	600	600	600	600
Conversion payment ^{e,g}	450	450			
Supplement for environmentally sensitive areas	500	500	500	500	500
Payment for farms without dairy quota	2,000	2,000	1,200 ^{a,c}	500 ^{a,c}	500 ^{a,c}
Payment for pig production ^b			2,000	2,000	2,000
Maximum area payment per hectare including EU direct area payments	5,000	5,000	4,000	3,500	3,500
Maximum payment for pig farms	5,000	5,000	5,000	5,000	5,000

Source: Bekendtgørelse no. 226 1997, no. 881 1998, no. 883 2002, no. 700 2007, Direktoratet for FødevarerErhverv 2002

^a Not paid to pig farmers

^b This payment expired on 2 November 2002

^c This payment was introduced in December 1998. It was not paid for the five-year period that followed

^d 850 DKK until December 1998

³ 200 DKK until December 1998

^f Before 1 January 1998, this payment was not paid to permanent grass fields

^g Not paid to permanent grass fields

In 2000, it was clear that the organic subsidy scheme had to be simplified after several years with considerable overproduction of organic milk and cereals. Therefore, support schemes directed at selective commodity groups had to be abolished. In the new organic support scheme which came into effect in 2004, the permanent organic subsidies were abolished. Instead, organic farmers were paid an environmental subsidy for which also other types of environmentally friendly farming were eligible, but organic farming had first priority. The only remaining organic subsidy was the general conversion payment for which only non-dairy farmers were eligible. Up until 2007, there was no wish to increase organic milk production, and therefore it was decided that they were not eligible for conversion subsidies. However, when market forecasts in 2006 envisaged future under-supply of organic milk production, dairy farmers again became eligible for conversion subsidies (interview, Directorate for Food, Fisheries and Agri Business, 13 December 2007). The current subsidy scheme is shown in Table 4.

Danish organic farming policy also applies a number of *indirect supply-side policy instruments*. From 1984 until 2002, government subsidies have been provided to organic extension services. More importantly, considerable government funding for research into organic farming has been provided since the mid-1990s. Most of the research has been

Table 4 Current organic area payments, 2004 to present (DKK per hectare)

Year of five-year obligation period	1	2	3	4	5
Perm. payment for environmentally friendly farming	750	750	750	750	750
Conversion payment ^a	1,050	1,050	100	100	100

Source: Bekendtgørelse no. 867 2003, no. 866 2003, no. 700 2007

^a Not paid to dairy farmers 2004–2007

funded by three organic research programmes under the auspices of the Danish Research Centre for Organic Farming (later the International Centre for Research in Organic Food Systems).

The Law on Organic Farming enacted in 1987 introduced some demand-side policy instruments. A government certification and labelling system for organic farming (the 'Ø' label) was set up. All costs related to certification of organic producers, processors and distributors and inspection activities are covered by the government. The state label is the sole national organic label and can only be applied by enterprises producing, processing, packaging or labelling organic produce *in* Denmark. Only state-certified farms would be allowed to sell organically labelled products and receive government support. The inspection activities under the state certification system are undertaken by the Plant Directorate which is an agency under the auspices of the Ministry of Food, Agriculture and Fisheries.

The 1987 Law on Organic Farming also granted financial support for development initiatives related to processing, marketing and distribution of organic food. For instance, support was granted to test marketing of organic dairy, poultry and beef products. Funds allocated to these activities peaked in 2000 with 97 million DKK, declined to 10 million DKK in 2005, but increased again in 2007 to 40 million DKK. Between 1997 and 2000, the government allocated 20 million DKK to training and other conversion activities in state, regional and local government canteens and kitchens (including hospitals) which wanted to use organic produce (Strukturdirektoratet 1999, p. 28). After 2000, the programme has been retained, but now as part of the Innovation Act (Bekendtgørelse no. 318 2001 and Bekendtgørelse no. 865 2006). The School of Organic Sales received support to provide advice to these institutions. Further, since 1998, the Veterinary and Food Safety Agency has launched a number of information campaigns on organic food directed towards consumers, retailers and processors. The agency is regularly involved in organic exhibitions (Strukturdirektoratet 1999, p. 26, see also www.dffe.dk).

As argued above, the environmental charges may also have an impact on green industry growth. In 1995, the Danish government introduced a pesticide tax equal to 37% of the retail price on insecticides and 15% on fungicides, herbicides and crop growth-regulating chemicals. The revenue was reimbursed by suspending the state's share of the regional land tax. In 1998, the pesticide tax was doubled and the revenue was to be used to fund subsidies for organic farming, monitoring of pesticide pollution and policy measures to limit nitrate pollution. Thus, the new pesticide tax proceeds, to a great extent, would redistribute money from conventional to organic farming. Though pesticide tax revenues fund organic farming, the introduction of the tax was not motivated by organic farming concerns, but by raising concerns about pesticide residues in the ground water which is the major source of drinking water in Denmark (Daugbjerg 1999, p. 124). Nevertheless, the tax may have a direct, but very limited, impact on organic sector growth.

Fig. 3 Allocation of the annual budgets for the organic sector policy. Own calculations based on Økonomistyrrelsen (various issues), Direktoratet for FødevareErhverv (various issues) and Fonden for Økologisk Landbrug (various issues). The budgetary spending includes both direct state outlays and outlays of Land Tax Foundation (*promilleafgiftfonden*) and the Foundation for Organic Agriculture. The two foundations were established to fund activities in the agricultural sector (e.g. research, advisory services, education and sales promotion). Their revenue sources are land and pesticide taxes. The Minister of Food, Agriculture and Fisheries appoints their governing boards on which representatives of the agricultural sector form the majority. The Foundations are administered by the Agricultural Council, which is an umbrella association for farmers' unions and business associations

5.2 The costs of Danish organic policy

As stated above, infant industry promotion policies may often be a mix of different instrument types, but usually the balance tips towards either demand-side or supply-side manipulation. Figure 3 accounts for the annual budgets for the organic sector policy. It clearly shows that in terms of funding allocation, the Danish organic farming policy has increasingly been supply-side orientated. In the formative years in the late 1980s and early and mid-1990s, the major part of the funding was spent on indirect demand-side instruments, but since 1996, spending has increasingly been directed towards supply-side instruments. Based on the allocation of government funding, Danish organic farming policy is characterized by an orientation towards the supply-side.

6 Conclusion

In 2007, 20% of all electricity production was generated from wind energy, the highest share in the world. Organic consumption has been considerably lower, stabilizing around 5% in the late 1990s and early 2000s. Not until 2006 did organic consumption show a renewed upward trend. Our comparison of the government policies implemented in the two industries clearly demonstrated that the packages of policy instruments applied were significantly different. The Danish wind turbine energy policy has concentrated on direct

demand-side policy instruments which have created demand for wind energy by obliging energy utilities to buy wind energy at a price above fossil fuel energy. To compensate for the extra costs associated with the purchase of wind energy, utilities were allowed to introduce a levy paid by all electricity consumers. This price premium made it economically lucrative to supply wind energy, and this was an important driving force behind the sector's growth.

In contrast, since the mid-1990s, the Danish organic farming policy has, in budgetary terms, relied heavily on supply-side policy instruments, mainly farm subsidies (direct supply-side instruments). However, in comparison with other European countries, the Danish organic farming policy has devoted more resources to demand-side policy instruments (Halpin et al. [forthcoming](#)), but they have not been as effective as those applied in the wind energy sector. Softer indirect demand-side instruments such as marketing and product innovation subsidies and market facilitation through the introduction of a state organic certification and labelling have been applied.

Our findings indicate that the reliance on demand-side measures in the wind energy sector has been more effective than the extensive and predominant use of supply-side instruments in the organic food sector though some demand-side instruments have been applied too. However, the taxation on power generated on the basis of fossil fuels seems to have had a more profound impact on the growth in wind energy than the pesticide tax on the growth of the organic food sector. Nevertheless, there are strong reasons to suggest that the different policy packages directly applied in the two sectors can explain variation in growth, measured as market shares. The use of demand-side instruments in the wind energy sector has brought about compulsory consumption while organic consumption remains voluntary. This makes an important difference for investments in the two sectors since returns in the former sector can rely on government guaranteed price premiums, while returns in the latter to a much higher extent must be based on price premiums generated in the market through increased demand. As to the wind energy sector, this conclusion is supported by Madsen et al. (2003, p. 27), who points out, 'Without these subsidies [i.e. price support], windmills as suppliers of electricity would not have been competitive compared to traditional power plants and hence the producers of windmills would not have got a foothold in the Danish industry' (see also Gipe 2006).

An important question is whether the lessons from the wind turbine sector can be applied in the organic farming sector.¹ Would it be possible for governments, or the EU, to guarantee prices for organic produce above the market price for conventional produce? Administratively speaking, yes. The Common Agricultural Policy (CAP) has operated such a system since the mid-1960s and still does for a number of commodities, for instance for dairy products. Thus, the administrative set-up is available, but would it also be politically feasible? Since 1992, CAP has undergone several reforms which have shifted support to farmers from price support to direct payments. In 1992, the major change to the CAP's price support mechanisms came in the cereals sector where intervention prices were reduced by a third, but farmers were compensated for the implied revenue loss by the introduction of a subsidy paid on each hectare of eligible land on which an eligible arable crop was grown (the arable area payments scheme). In 2003, direct aid payments based on the area farmed and crops grown, and type and number of livestock kept, were decoupled from production and transformed into a new Single Payment Scheme (SPS), often referred to as the single farm payment.

¹ The EU does provide subsidies for organic farming through the so-called second pillar of the Common Agricultural Policy. The subsidies are provided as producer support and are thus supply-side measures.

The 2008 Health Check reform of the CAP further decoupled farm payments from production. The motivation behind this gradual and partial transformation of EU agricultural subsidies has been a need to make them less trade distorting to reach agreement on farm trade rules in the WTO (Daugbjerg and Swinbank 2009). Price support artificially drives up production by enabling production which otherwise would be unprofitable and has caused massive overproduction in the past. Introduction of price support in the organic farm sector would be a move in the opposite direction and would not be well received by the EU's trading partners in the WTO. In advocating more market orientation of the CAP, the Deputy Chief of Cabinet to the EU Farm Commissioner, when promoting the Commission's proposal for the 2008 Health Check CAP reform package to the European Association of Agricultural Economists in August 2008, said on the instruments applied in price support: 'These instruments should not be applied anymore as "price setters" on the markets, but as instruments that keep farmers in business in case of dramatic market disruptions' (Borchardt 2008, p. 5). Thus, it is most unlikely that the wind turbine model would be introduced in the organic sector.

However, this is not to say that no lesson can be learnt from the policy model developed for the promotion of the wind turbine industry. The Danish case of wind turbine promotion clearly demonstrates that demand-side policies may be very effective in promoting a green infant industry. Future research should attempt to further explain why Denmark performs so well in wind energy compared to other European countries. Other countries have also applied demand-side policies but with much poorer results. A detailed cross-country analysis would help to identify the optimal design of effective demand-side policies.

While the model cannot be directly transferred to the organic sector, our analysis encourages new thinking on organic sector policies. Demand-side policy can still be further developed. If the aim of government is to increase the size of the organic market, more attention should be given to the stimulation of demand for organic produce. Government possesses means to do so, such as lowering the value added tax for organic food or introducing obligations for public sector canteens and kitchens to purchase organic products where available. Though there may be political opposition to such measures, the act would be less interventionist than the policy model applied in the energy sector.

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