# The Development of Organic Farming in Europe[1]

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# Abstract

The paper sets out a dynamic framework for analysing the impact of public support on the growth of organic farming in Europe. Although the empirical results are uncertain, it appears that national support and EU certification have accelerated the process of expansion without significantly changing the long-term size of the organic sector.

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# Introduction

Since the early 1980s, the organic farming sector has developed considerably in Europe. In most countries this process is supported by national or EU support, by certification schemes etc. The aim of the present paper is to analyse the impact of public support on conversion. From the perspective of mainstream economic theory (assuming constant preferences and technology), the introduction and removal of support would be entirely symmetric in terms of market shares of the organic sector. In other words, the organic sector would be highly vulnerable to a reduction or abolition of public support. Although the assumptions of constant preferences and technology appear unrealistic in this context, it remains a central issue to what extent market shares for organic products hinge on public support and to what extent public support simply advances the process of conversion.

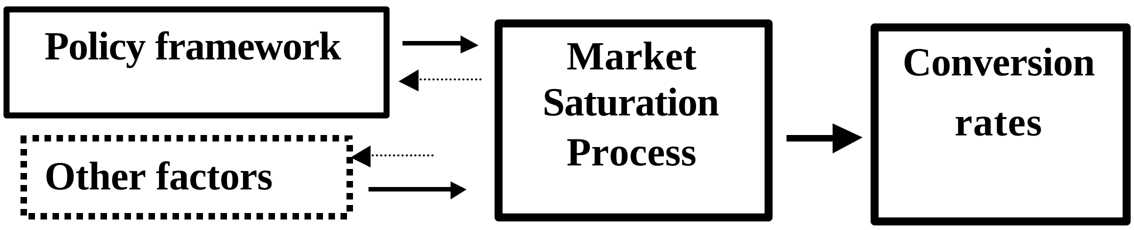
The analysis is based on data for 18 European countries. For each country the data covers the number of certified farms as well as their area for 1985-97. As explanatory variables a number of key events (drivers) - such as the implementation of organic support schemes or the introduction of national organic logos - are included. Unfortunately, there is no data on the types of farming, on the level and type of public support, on relative prices of organic products, etc.

In order to come to grips with the processes behind the data, Section 1 sets out some theoretical ideas, linking the national policy framework with the expansion of the organic sector. Some of these involve variables not included in the data basis, and in Section 2 a more data orientated model framework is therefore developed. The relevancy of this framework is illustrated in Section 3, using the development of organic farming in Denmark as an example. Section 4 presents a more comprehensive analysis of all of the countries in the sample. Finally, a conclusion is reached in Section 5.

# 1. Some analytical reflections

As mentioned above, this study is an impact analysis seeking to detect the impact of (national) policies on the development of organic farming throughout the 18 countries. Hence, the basic analytical framework may be illustrated as in Figure 1.1 below.

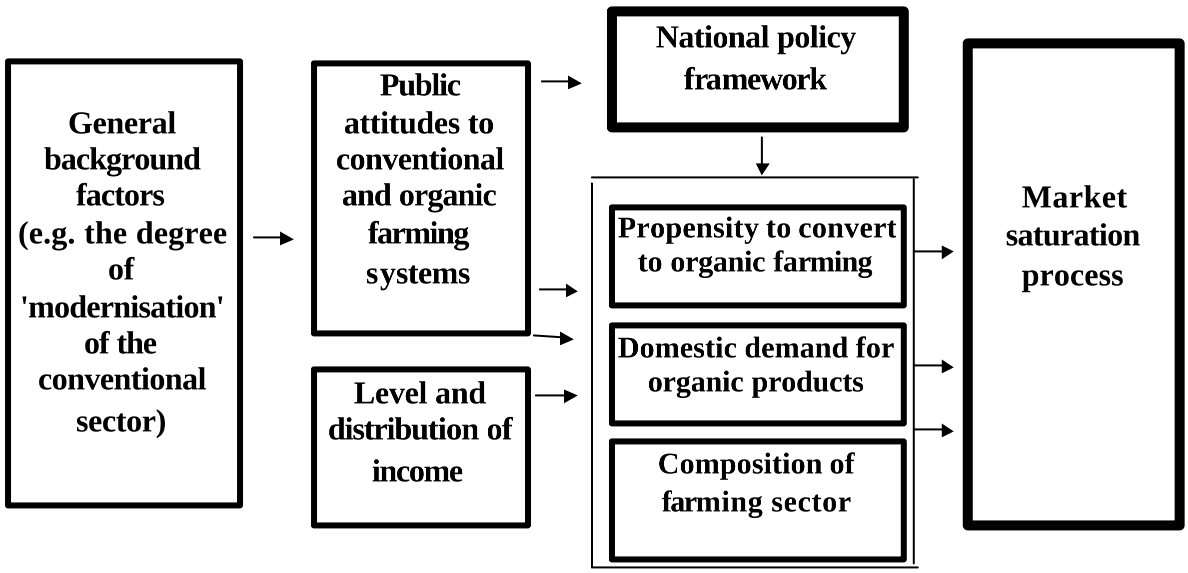
***Figure 1.1  The basic framework for analysis***




Although the arrow represents the central causal relationships to be uncovered, the model may be misleading as a basis for interpreting cross-country correlation between policies, market size and market growth.

Other factors are likely to exercise a highly significant influence on the market saturation process. One such factor is the composition of the national agricultural sector. It is well known, for example, that milk production is more easily converted than is pig production and that organic fruit growers are faced with serious difficulties in their attempts to avoid blemishes without using pesticides. Another significant factor is the local (national) demand for organic products. Although organic products are increasingly being traded internationally, the home market normally has an important role to play, especially in the early stages of market development. Both the market demand for organic products and the political demand for policies to support organic farming may be seen to reflect the public response to problems attributed to the modernisation of the ‘conventional’ farming sector.

***Figure 1.2 A more elaborate causal model***




Finally, important factors (e.g. the establishing of organic farmers’ unions or the outbreak of a BSE crisis) are likely to affect both markets and policies very substantially. This line of reasoning may give rise to more complex analytical models such as the one presented in Figure 1.2, which places the original model of Figure 1.1 in a wider socio-economic context. The central idea behind this figure is that organic farming represents a reaction to the modernisation of the conventional sector (see e.g. Frouws & van Tatenhove 1993, Goodman and Redclift 1989; Lowe et al 1990).

Figure 1.2 above points to relevant variables – such as public attitudes or the level and distribution of income – for which we have no data. Earlier research (Bager & Søgaard 1994; Søgaard 1997) suggests that farmers' attitudes play an important part in the decision to convert. From an economic perspective it would seem useful to have had data on the types of farming, on the level and type of public support, on green taxes imposed on conventional farming, on relative prices of organic products, etc. For example, consider the impact of a labelling system imposing additional costs on producers while guaranteeing the quality of their produce. From the point of view of static equilibrium theory one would expect this to increase demand at any price, thereby displacing the demand curve to the right, while shifting the supply curve to the left. In terms of the volume of production the net effect is uncertain. The principal impact of such a policy could be to raise the price of organic products – an effect that will not show up in the present analysis.

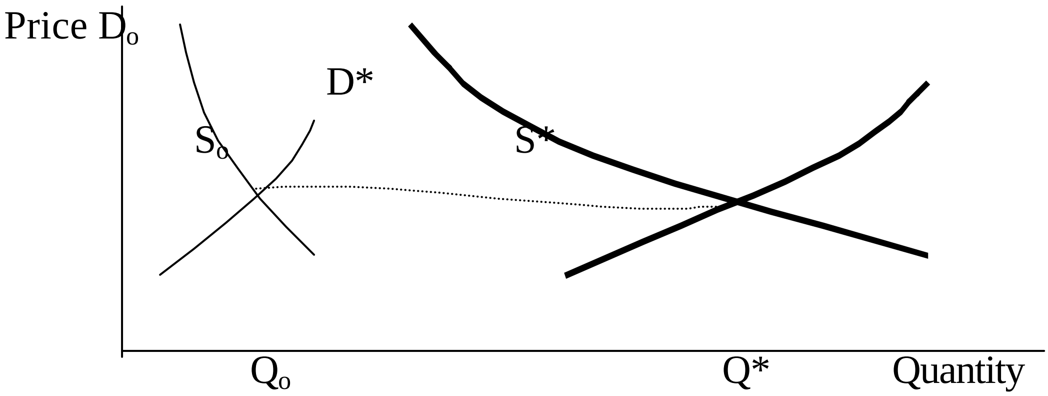
The approach adopted here is not that of static equilibrium theory, however. On the contrary, the processes behind the data involve a mixture of very long-term changes towards more post-materialist values (Inglehart, 1977); medium term market penetration processes; and discrete changes such as the implementation of organic support. Some of these are included as drivers in the present analysis. It seems probable, however, that a number of drivers are missing. For deeper accounts of the policy, institutional and regulatory environment in Europe the reader is referred to Michelsen (1996); Lampkin et al (1999); Michelsen et al (1999).

In order to assess the impact of policies and other drivers on the growth and long-term market shares of the organic sector it is necessary to define benchmarks describing what would (or might) have happened in the absence of those drivers. The existing data is in two dimensions: a time-series dimension and a cross-country dimension. Both dimensions may help fix the relevant benchmark values of growth rates and long-term number of organic farms.

# 2. The data and model framework

In this Section, we shall consider the internal dynamics of the expansion process. The approach adopted here is inspired by the literature on the diffusion of innovation (e.g. Casetti et al 1972; Metcalfe, 1989). For a given policy (or ‘events’) regime it is posited that a long-term steady-state number of organic farms exists. Diffusion processes on both sides of the market will gradually shift supply and demand curves outwards (*or* inwards) toward some imaginary long-term equilibrium.

***Figure 2.1 Diffusion processes and market development***




The assumption is that for a given regime the proportion of organic farms will tend to gravitate towards its steady-state level. The aim of this paper is to analyse how policy regimes affect the steady-state size of the organic sector as well as the rapidity of the conversion process.

To begin with, consider the process of conversion from the supply side of the market. Let the steady-state number of organic farms be denoted by $Q^*$. It follows that the number of potential converters is given by $Q^* - Q_t$; $Q_t$ being the number of organic farms at date t.

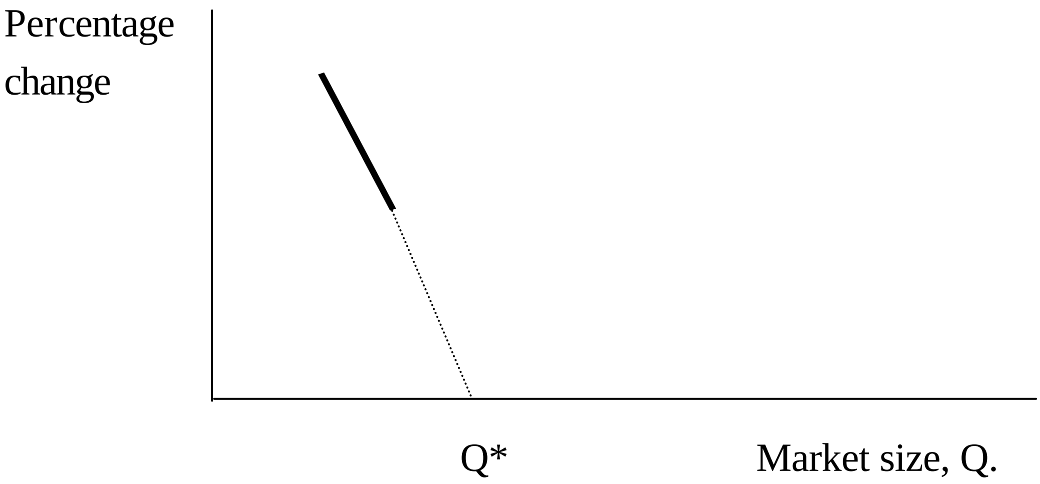
As long as organic farmers are few and far between ($Q_t$ is small), they are likely to be looked upon as outsiders by the conventional farming community. At this stage the long-term commercial viability of organic farming is highly uncertain, and the knowledge of organic farming methods is poorly developed and not easily available. All of these factors combine with high distribution costs and other difficulties to prevent potential converters from converting. It seems reasonable to assume, therefore, that the individual propensity to convert is positively related to the number of already converted farmers ($Q_t$). Moreover, inspiration from existing organic farmers – the power of example – appears to be a central propagation mechanism. This is consistent with the clusters of organic farmers found in Jutland (Hamm, U. & Michelsen, J. ,1996).

In the special case where the average potential converter's propensity to convert within the next time period is directly proportional to $Q_t$, the growth of organic farming will be determined by the first-order differential equation:

$$\Delta Q = \beta Q(Q^* - Q) \qquad (1)$$

$\beta$ being a positive constant. The solution to this equation is a logistic growth function. For small values of Q, the absolute growth ($\Delta Q$) will also be quite small.

***Figure 2.2 The market-change (MC) diagram.***




It follows from (1), however, that

$$\Delta Q/Q = \beta(Q^* - Q) \qquad (2)$$

Thus, the *relative* (percentage) growth of the market is a negative linear equation in Q. By extrapolating historical observations on market size and market growth, one obtains an estimate of the size of the saturated market, Q*. Moreover, the (numerical) slope of the line is given by $\beta$ - the rate of market penetration. These are very useful results.

The assumptions underlying the pure logistic growth model are too simplistic, however. Eq. (1) is a special case of

$$\Delta Q = P(Q)(Q^* - Q) \qquad (3)$$

where $P(Q) = \beta Q$ is the average probability of a potential converter to convert within the relevant time period. Dividing (3) by Q yields

$$g(Q) = \Delta Q/Q = (P(Q)/Q) * (Q^* - Q) = h(Q)(Q^*-Q) \; ; \; h = P/Q \qquad (4)$$

The precise shape of P is unknown, of course, but the assumption that P is directly proportional to Q for $Q \leq Q^*$ and drops sharply to zero beyond Q* does not seem plausible. More realistically, one might expect P to be positively related to Q in the initial stages and decline towards 0 as Q approaches Q* (and the pool of potential converters is exhausted). Although the propensity to convert is positively related to the number of already converted farmers ($Q_t$), potential converters' propensity to convert within the next time period is probably less than proportional to $Q_t$; ($h' < 0$). In terms of inspiring new conversion 500 organic farmers may do better than 100, but they are unlikely to do 5 times as well. Most likely, this will cause the MC curve to be *convex* rather than a straight line[2].

It is useful, therefore, to transform the data. A pragmatic way of doing so, which facilitates cross-country comparisons, is to substitute the natural log for the absolute number of organic farms ($q_t = \log Q_t$), and measure relative growth in terms of $\Delta q_t$. In this way equation (2) translates into:

$$\Delta q_{t+1} = \beta_t (q_t^* - q_t) \qquad (5)$$

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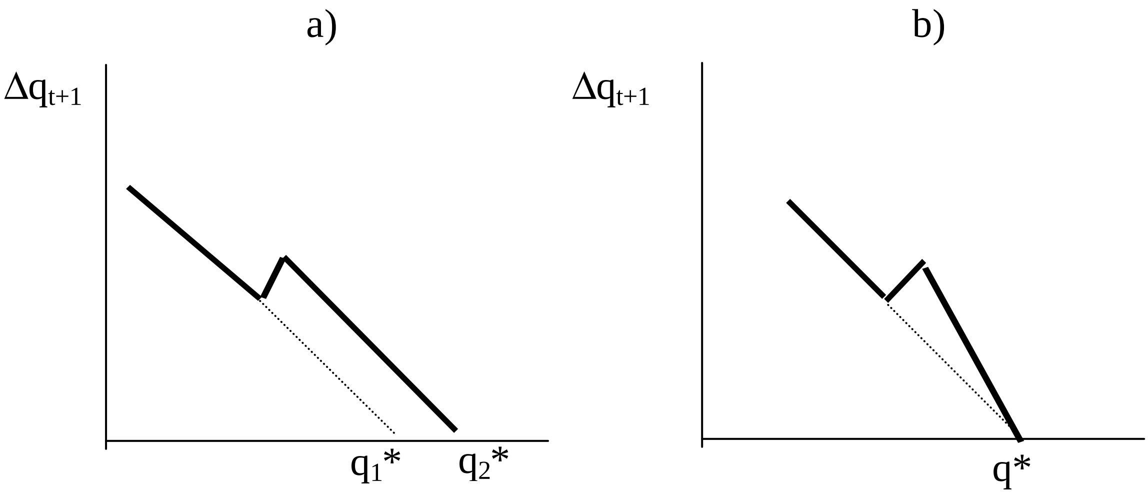
2 Assume, for example, that $P(Q) = \beta Q(Q^* - Q)$, i.e. P is a parabolic function assuming its maximum for $Q = ½Q^*$. It follows that $g(Q) = \beta(Q^*-Q)^2$, which is minimised for $Q=Q^*$. Since $g'' = 2\beta$, g is clearly convex.

where $\Delta q_{t+1} = q_{t+1} - q_t$. A policy change at date t is thought to influence either the rate of conversion, β or the steady-state level, q*, or both.

***Figure 2.3 Hypothetical Market Change curves a) shifting q* and b) shifting the value of b.***




*A priori* one would expect conversion support to raise the value of β without necessarily adding much to q*, while permanent support for organic farming should be expected to increase q* without necessarily raising the value of β. In Figure 2.2a the impact of an increase in q* is shown. Note that after the initial increase, growth rates ($\Delta q_{t+1}$) continue to decrease. The decrease is even sharper, however, for policies accelerating the process of conversion without raising the steady-state number of farms, q*.

The above analysis is based on the assumption that, initially at least, the expansion of the organic sector is mainly supply driven. However, it seems reasonable to assume that similar diffusion dynamics are at work on the demand side. Although the expansion processes on the two sides of the market are mutually supportive, the time lag caused by the expansion period may give rise to cyclical 'cobweb'-dynamics similar to those of the classical hog cycle. This may cause the market change curves to fluctuate up and down.

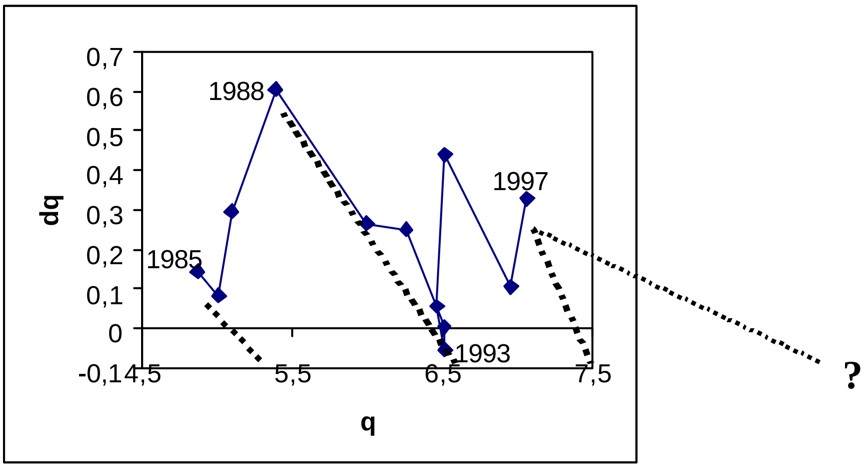
# 3. The Danish case

In this Section the growth of organic farming in Denmark will be used as an example to illustrate the relevance as well as the limitations of the model for empirical analysis[3].

Various kinds of support were implemented in the late 1980s. In 1987, a law on organic farming was passed in Parliament and a national organic logo (the red Ø label) was introduced. In 1988 the 'green majority' in Parliament implemented the original organic support scheme. Market support became available for so-called development projects concerning the manufacturing and marketing/distribution of organic produce. In terms of the steady-state level of organic farming, this apparently raised the level of q* to about 6.5 (= log 665) – a level which was reached in the early 1990s with 640 certified farms in 1993 and 677 certified farms in 1994.

3 A more comprehensive review of the developments for all 18 countries is given in Michelsen and Søgaard (1999).

Figure 3.1. Market Change curve for Denmark




In 1993 a number of significant new drivers gave a fresh impetus to the process of conversion. Directives 2078/92 and 2092/91 were implemented, and the national consumer co-op (*FDB*), with about 1/3 of the national retail market, launched its national marketing campaign. Not surprisingly, all of these factors combined to stimulate the process of conversion, and by 1997 the number of certified farms had reached 1,617 – nearly three times the level of 1994.

As expected, significant drivers coincide with jumps in growth rates, displacing the downward sloping Market Change curve upwards. The dashed lines indicate the slope of this ‘autonomous’ curve. However, the data does not allow us to assess the relative impact of the various drivers introduced in 1993. For this purpose, a cross-country analysis is required.

# 4. A cross-country analysis

Table 4.1 below compares growth rates for countries with national support with growth rates for countries without national support. All growth rates refer to growth in the number of organic farms. For countries with national support, growth rates from three to one years before the introduction of national support, from one year before to one year after, and from two to five years after the introduction were calculated. For countries without support, growth rates for 1987-1990 ("before"), 1990-1992 ("during"), and 1992-1995 ("after") were calculated for comparison. Both groups of countries were ranked according to differences between growth rates "before" and "after" national support. These figures are given in columns 3-5.

Data on Greece, Portugal, and the Czech Republic were left out due to lack of data for the relevant years. Furthermore, with less than 20 certified farms Luxemburg was omitted.

*Table 4.1. Annual growth rates before, during, and after the introduction of national support**

| Country | National Support | Annual growth (per cent) | | | Average annual growth | Change in growth rates** |
|---|---|---|---|---|---|---|
| | | "before" | "during" | "after" | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Italy | None | 23.3 | 29.1 | 62.0 | 38.2 | 89.5 |
| 2. Spain | None | 3.0 | 29.3 | 21.2 | 15.9 | -62.2 |
| 3. UK | None | 5.3 | 6.9 | 1.2 | 4.1 | 10.4 |
| 4. Netherlands | None | 10.0 | 10.8 | 4.6 | 8.1 | 0.8 |
| 5. Belgium | None | 15.8 | 4.9 | 9.0 | 8.2 | 25.2 |
| 6. Ireland | None | 42.4 | 14.0 | 24.7 | 28.1 | 20.5 |
| **Average 1-6** | | **16.6** | **15.8** | **20.4** | **17.1** | **14.0** |
| 7. Austria | Nat.support | 36.9 | 97.4 | 45.7 | 53.6 | -31.1 |
| 8. Denmark | Nat.support | 7.8 | 56.8 | 16.9 | 22.0 | -71.2 |
| 9. France | Nat.support | 0.4 | 8.8 | 6.1 | 4.5 | -10.3 |
| 10. Swiss | Nat.support | 14.6 | 28.7 | 20.5 | 17.7 | 4.6 |
| 11. Germany | Nat.support | 13.1 | 21.6 | 13.9 | 13.5 | -21.2 |
| **Average 7-11** | | **14.6** | **42.7** | **20.6** | **23.2** | **-25.8** |
| 12. Finland | Nat.support | 74.7 | 59.6 | 24.2 | 50.2 | -26.2 |
| 13. Norway | Nat.support | 67.3 | 114.6 | 10.4 | 52.3 | -57.6 |
| 14. Sweden | Nat.support | 64.3 | 54.5 | -1.7 | 33.4 | -1.44 |
| **Average 12-14** | | **68.8** | **76.3** | **10.9** | **45.3** | **-28.4** |

* Countries ranked according to the difference between growth rates.

** Change in growth rates = Percentage change from 2 to 4 years minus percentage change from 1 to 3 years after the introduction of national support (or 1991).

Column 6 shows the average annual growth rates for the whole period. As shown in Figure 2.2b above, the introduction of a driver such as national support may accelerate the penetration process without necessarily raising the long-term steady-state level of organic farming. In this case, growth rates after the introduction of the driver should be expected to decrease faster (but from a higher level) than they would have done had the driver not been introduced. As an indicator of this, column 7 gives the change from 1 to 3 years minus the percentage change from 2 to 4 years after the introduction of national support (or 1991).

On average, countries with national support enjoyed higher growth rates (changes in q) before the implementation of national support than did those without. As mentioned above, both groups of countries were ranked according to differences between growth rates “before” and “after” national support. This ranking reveals that the higher initial growth rates for countries with national support is explainable by the extraordinarily high growth rates of three Scandinavian countries – Finland, Norway and Sweden. For obvious reasons these growth rates cannot be attributed to national support. It is conceivable that local factors behind the high growth rates in this particular region may also have contributed to the introduction of national support (cf. Figure 1.2 above).

Leaving out these countries, one has average growth rates for Austria, Denmark, France, Switzerland, and Germany of 14.6 per cent per year before the introduction of national support. From two to five years after this policy change, growth rates for those countries had increased to 20.6 per cent on average. In comparison, Italy, Spain, the UK, the Netherlands, Belgium, and Ireland enjoyed average growth rates of 16.6 per cent in the “before” period and growth rates of 17.1 per cent in the “after” period.

For the whole period growth rates for countries 7-11 were slightly higher, on average, than for countries without national support. This difference is far from significant, however, and the faster decline in growth rates for countries with national support suggests that national support has first of all accelerated the process of conversion.

Column 7 shows that growth rates decreased more rapidly for countries with than without national support. In fact, growth rates *increased* for countries without national support, which suggests that other positive drivers have influenced growth rates after 1991.

In order to get a clearer picture of this, a statistical model was set up to differentiate between changes in $\beta$ and changes in q* and distinguish between the impact of national support and the major EU policy drivers, Directive 2078/92 and 2092/91.

This was done in three steps:

To begin with, the dominant policy regime for each period (in terms of national support, D2078/92 and D2092/91) was defined as a vector of dummy variables.
Secondly, values of $\beta$ and q* were estimated for ‘autonomous periods’ by reviewing national developments, as illustrated above.
Finally, the relationship between *changes* of policy regime and *changes in* $\beta$ and q* were found by means of regression analysis.

*The dominant policy regime*
The policy regime is defined here by three major policies: national support, D2078/92 and D2092/91. All of the three policies are treated as dummy variables, which means that differences in terms of amounts or types of support have not been taken into account.

National support existed in 7 countries before the introduction of D2078/92, with substantial variations from country to country both in terms of payment rates, eligible crops, and types of support (Michelsen *et al*, forthcoming).

Directive 2078/92 was passed in 1992. Under this Directive various forms of support (financial support, support for market and regional development, and support for information and education) have been implemented.

With Directive 2092/91 a common certification standard for organic plant production was introduced. In principle, the regulation laid down uniform certification standards for all fresh and processed produce of plant origin, but the supportive arrangements appear to differ substantially between countries. Organic food products are credence goods. As a result, the potential demand for these goods is liable to be highly sensitive to labelling and enforcement practices accompanying the national implementation of D2092/92.

In general, the policy regime vector presented here is at best a very crude estimator of the 'true' regime. From an analytical perspective, data showing more precisely the level and type of support (conversion support, permanent support, certification) would obviously have been preferable. Since the policy vector is used here as the explanatory variable, this will not only add to statistical uncertainty but also cause coefficients to be biased towards zero.

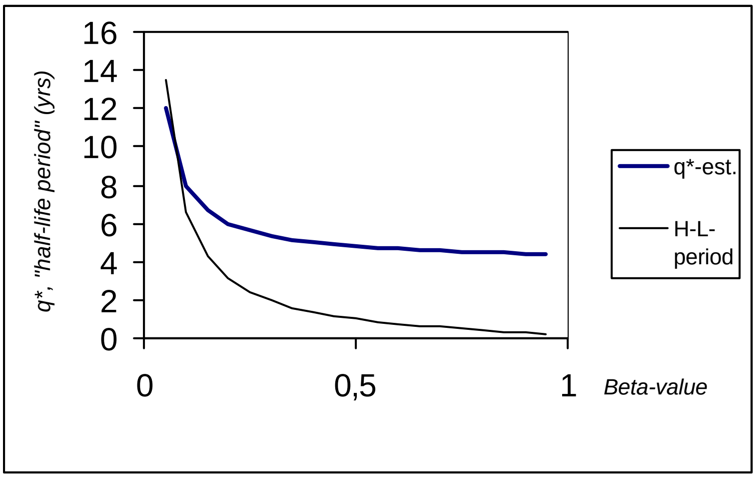
*The estimation of slope parameters*

As indicated above, the estimation of the slope parameter is rather uncertain. With statistically independent error terms on q, a reasonably unbiased estimator[4] is

$$\beta = 1 - \mathrm{std}(q_{t+1})/\mathrm{std}(q_t) \qquad (6)$$

for periods of 'autonomous' development (e.g. 1988-93 for Denmark). The consequences of positive and negative error terms are far from being symmetrical, however. By underestimating β, one may vastly overestimate both the penetration period and the steady-state number of organic farms, as shown in Figure 4.1. In order to counter this tendency values of β were found by regressing $q_{t+1}$ on $q_t$ for 'autonomous' periods.

*Figure 4.1* ***The relationship between b, estimated values of q* and "half-life periods"***




This estimator will be biased towards over-estimating β. It follows from (5) above that

$$q_{t+1} = \beta_t q_t^* + (1-\beta)q_t \qquad (7)$$

By regressing $q_{t+1}$ on $q_t$ one obtains a negatively biased estimator of (1-β) and hence a positively biased estimator of β. Due to the relationship between estimates of β and q*, this option was preferred.

4 The estimator is in fact slightly biased towards zero, i.e. towards underestimating β.

The 'half-life period' of Figure 4.1 refers to the time required to halve the gap between the actual value of q and the steady-state level q*. This period depends on β. For example, for β = 0.1 the half-life period is 6.6 years, and for β = 0.5 it is 1 year (half a conversion period). It seems reasonable, therefore, to expect estimated values of β to fall within this range. On average, the estimated values come close to 0.5, which suggests that the penetration period is quite short.

*Policy regimes, penetration rates and steady-state levels*

Finally, the policy vector was regressed on the estimated values of β to obtain:

$$\Delta\beta = \underset{(2.69)}{.47}\ \Delta NS + \underset{(.77)}{.18}\ \Delta D2078/92 + \underset{(1.93)}{.45}\ \Delta D2092/91 \qquad (7)$$

$R^2 = .49$; N=12

Both the first coefficient (on changes in national support, NS) and the last one (on D2092/91) are statistically significant at the one-sided 5% level, which shows that national support does advance the process of conversion. As shown in Table 4.1 the data appears to be spatially autocorrelated, however, which means that t-ratios should not be taken at face value. Furthermore, with the very low value of $R^2$ one cannot rule out the possibility that the observed coefficients are affected by multicollinearity with variables not included in the model. Despite collinearity between 2078 and 2092 (which were introduced simultaneously in many countries), the coefficient on D2092/91 is almost equally significant, whereas the impact of D2078/92 is somewhat weaker and statistically insignificant. It deserves notice that the certification scheme comes out so strongly.

In order to test the impact of the policy regime on steady-state levels, q*, the β values were used to calculate values of q*. The policy vectors were then regressed on these to get:

$$\Delta q^* = -.06\, \Delta NS - .73\, \Delta D2078/92 + .14\, \Delta D2092/91 \qquad (8)$$
$$\qquad (-.14) \qquad (-1.21) \qquad (.24)$$

$R^2 = .21$; N=12

Surprisingly, coefficients on national support as well as D2078/92 turn out to be negative. None of the coefficients are statistically significant, however, and there is no basis for concluding that support policies should have a negative impact on the steady-state size of the organic sector.

The very small number of observations underlying (7) and (8) is due to the fact that for some countries there are no measured changes in values of β and q*. (It takes two values to obtain one difference). For example, for Denmark (cf. Figure 3.1 above) it is not possible to estimate q* for the post-1997 period without imputing a value of β. It follows from (8) that β values have increased over the years. With imputed β values of 0.5 one obtains the following estimate:

$$\Delta q^* = .01\, \Delta NS - .38\, \Delta D2078/92 - .14\, \Delta D2092/91 \qquad (9)$$
$$\qquad (-.09) \qquad (-1.30) \qquad (-.40)$$

$R^2 = .15$; N=25

Again, the implementation of D2078/92 comes out with a negative sign. The one-sided p-value for this result is about 0.07. Although the negative sign is insignificant, this may be seen to indicate that the replacement of national support by D2078/92 may have exercised a negative impact on the steady-state level of organic farming in some countries.

# 5. Conclusions

This paper set out to analyse the impact of three major policy drivers on the growth of organic farming in Europe. The empirical results are generally uncertain and should be interpreted with caution.

Both the time-series and cross-country dimensions confirm the expectation that national support and certification under D2092/91 have advanced the process of conversion. The impact of D2078/92 on the conversion rate is uncertain. Somewhat surprisingly, the analysis cannot confirm the policy impact in terms of raising the long-term 'steady-state' level of organic farming. Time-series analyses of individual countries (Michelsen & Søgaard, 1999) suggest that policies do influence the steady-state number of farms (the implementation of national support has been followed by new waves of expansion). However, one should beware of the so-called *post hoc* fallacy: conversion *following* the introduction of a specific policy need not be *caused* by this policy.

The cross-country analysis of Section 4 does not suggest that there is a positive long-term impact of support on the steady-state number of farms. Italy, for example, has seen a rapid expansion of the organic sector without national support of any kind. This suggests that other drivers (e.g. the introduction of green labels, the building up of distribution channels, etc.) may be more important in the long term than national or EU support.

While these results cast doubt on the long-term efficiency of current support policies, they also confirm the impression that the dissemination of organic farming is an increasingly market-driven process. From a theoretical perspective, the most efficient (and irreversible) way of supporting this process might involve stimulating the development of products and methods of production, the building up of marketing and distribution systems, etc. within the organic sector.

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