RESEARCH IN ECONOMICS AND RURAL SOCIOLOGY

Value of the rural environment in periurban belts

An agricultural, forest or natural environment represents a setting that households may seek. By integrating this behaviour into an economic urban model, we generate periurban belts where farmers produce amenities that inhabitants consume. The resolution of this model gives predicted values of some variables that may be compared to the values observed in reality. Calibrating the model, that is to say minimizing the gap between predictions and observations, provides a value of unobservable variables, in particular the price of rural amenities.

Residential amenities of rural origin

Urban economics explain the choice of a place of residence by a trade off between the commuting and housing cost (which we assimilate with land rent). The further people are from an employment centre, the longer home-to-work commuting takes, but the additional cost is compensated for by lower land rent allowing the use of more residential space. In equilibrium, the two aspects make up for one another, so that for a given budget, a household is indifferent whether it lives near (expensive area but short commuting time) or far from employment centres (inexpensive area but long commuting time).

Among the enrichments added to the basic model, we take an interest in those which concern the heterogeneity of space. While cities offer amenities, they are also a source of nuisance (congestion, insecurity, pollution, excess mortality) which may encourage households to live in the outskirts where farming, though it also causes nuisance (noises, pollution and smells), preserves the environment: landscapes to see and open for walking, quietness and pure air are attributes of the multifunctionality of the agriculture and forest (included here in "agriculture" by extension).

The previous mechanism is extended to amenities: for a given budget, a household is willing to pay for a higher land rent, which reduces the size of the residential plot. Now the arbitration is made between three terms: accessibility to the city, size of the real-estate plot and consumption of amenities.

It is then possible to assess, from a model which formalizes this mechanism, the implicit price of these amenities. It is an important question to enlighten public policies. The price that the consumer attributes to amenities must be used as the basis to determine the remuneration of non market functions of agriculture and justify the corresponding budgets to the citizen and tax-payer. Furthermore, it is useful to show, for instance in international negotiations, that at least partly, these policies pertain to measures without a direct effect on production ("green boxes").

The methods of contingent valuation, transport cost and hedonic prices are authoritative for the valuation of these non market goods. Here we suggest a new method, of different conception, not as an alternative but as a supplement to the preceding ones.

Insert 1: The periurban area: a "mixed" area

In 1999, periurban municipalities as defined by the INSEE (French Institute of Statistics and Economic Studies) cover one third of the French territory. There are 21% of inhabitants and 44% of farms. For ~~the~~ urban economics, it is a mixed area where farmers and households co-exist. It is a "rural" area in the sense that agriculture and forests take up 75 to 80% of the land. It is an "urban" area in the sense that 79% the occupied active population commutes out of their residential commune, usually towards the urban hub.


Periurban belts with households and farmers

Households are sensitive to a so-called "farm" living environment (to make it simple), but which covers the characteristics of the mixed periurban area (insert 1) beyond agriculture: we think of the forest and "natural" areas. Because of this sensibility to a rural environment, in periurban areas an inhabitant is willing to pay for a higher

land rent than the one he would pay if, in the same place, the environment were an urban one with nearby housing and without rural amenities. We have a feeling that the difference between both rents [equal, at location y, to $F_d^a(y) - F_u^m(y)$ in figure 1, Insert 2] allows us to

assess, though indirectly, the value of this mixed living environment.

Figure 1
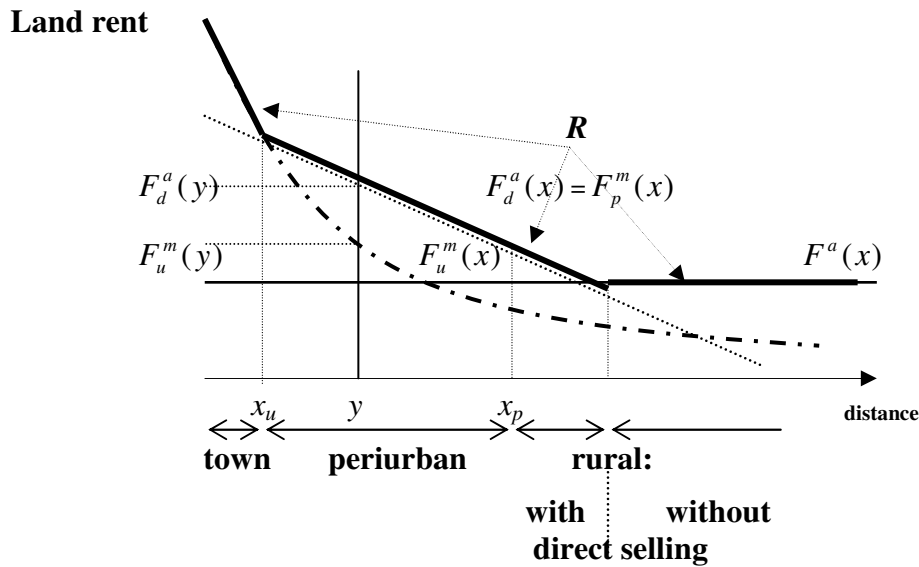
The landowner rents the land to the highest bidder (curb **R** in thick dotted lines): up to x_u we have a town (in the usual sense of the word: continuous housing, no rural amenities), then from x_u to x_p a periurban belt. Beyond, the distance to employment is too long for households and there are only farmers, practising or not direct selling. Solving the model helps determine the limits of the town and periurban belt, the size of the residential plots, the households' density and that of farmers, therefore, the quantity of amenities. They are the values predicted by the model.

For farmers, we observe that the land price decreases the further away people are from the city centres (see, for further information: "Urban influences on Periurban farmland Prices"). To give an account of it, we refer to Von Thünen, for whom farmers are sensitive to the distance between the city and their farm. There are all sorts of reasons for this: direct selling, expected capital gains from urbanization, educational farms, reception, work for local authorities and so on. We say they do "direct selling" of farm produce, a metaphor for all these reasons. Because of this direct selling, the land rent they are willing to pay depends on the distance to the urban market, which explains the decrease in land values up to a certain distance. The transport cost becomes prohibitive beyond this, and instead of direct selling, farmers produce farm foodstuffs for national or international markets. The rent no longer depends on the distance to the city. At all events, they also produce amenities, a by-product of their activity, the quantity of which depends on the cultivated area. These amenities are consumed by the households living nearby (if there are any): rural amenities provide them with a utility obtained through the housing of which they are a spatial attribute.

Insert 2: The equilibrium of the "periurban city" on the real estate market

Let us call $F_u^m(x)$ the land rent offered by households (exponent m) in an urban environment (index u), which results from the trade off between transport cost and land cost, $F_d^a(x)$ the land rent offered by farmers (exponent a) who do direct selling (index d) and $F^a(x)$ that of farmers who do not practice direct selling. At a location y, farmers offer the land rent $F_d^a(y)$, located on the right materialized by points. At y, in an urban environment without rural amenities, households would offer the land rent $F_u^m(y)$, located on the dotted curb with lines. If at y there are farmers, and therefore amenities, households offer a land rent higher than $F_u^m(y)$, which we call $F_p^m(x)$ (index p for periurban), which is equal to that of farmers. In such a case, the area is mixed. The volume of amenities offered by farmers allows the two rents to be equal. If there are too many farmers (respectively: too few), there are more (less) amenities than the equilibrium value, which attracts (repels) households and reduces (increases) the part of farmland, the volume of amenities being close to its equilibrium level until it is reached.

We suppose that the real estate market is competitive and that the landowner rents one plot to the agent, household or farmer who is the highest bidder. We have the intuition - verified by the analytical solution - that we only find households near the employment centre: because of short commuting, they only propose higher land rents than those of the farmers. Farther away, with longer home-to-work commuting, direct selling may become more competitive and farmers may settle. As their activity creates amenities (a by-product of farm foodstuffs), to benefit from them, households accept, all things being equal (in particular the same distance from city), to pay for a higher land rent than that which would correspond to an urban environment (Insert 2). The area may be mixed if both land rents, the household's and the farmer's, are equal: so the landowner is indifferent to renting his land to one rather than to the other. Beyond a certain distance, commuting distances are too long (or direct selling too unattractive) and the periurban belt gives way to the production of standard farm foodstuffs for the rest of the world. Figure 1 (Insert 2) illustrates these mechanisms.

Value of the residential amenities produced by farmers

The price of the rural amenities defined by the Lindhal-Samuelson approach is determined from the model (Insert 3). This price depends on unobservable parameters, such as the households' relative taste for rural amenities and the consumption of residential land, or the quantity of amenities produced by farmers. Therefore, within an applied approach, it would be of little interest if we could not estimate the value of these parameters to assess the price of amenities. The purpose of the calibration is to solve this problem (Insert 4).

We thus obtain an estimation of the implicit price of rural amenities with equation (1) (Insert 4). This result must be read with caution. It is the product of a new assessment method which must be tested and improved, for instance by making a calibration on several case studies or several fields of observation, to check whether the results are robust. Moreover, the implicit price is sensitive to the place of agriculture in the territory which, although its conceptual definition is simple, is not so easy to observe.

The price of rural amenities, which directly results from the calibrated model, is proportional to the farmland rent, in a factor close to the unit multiplied by a term which depends on the proportion of "farmland" (see equation (1), Insert 4). This multiplying factor greatly influences the result. It is equal to 0.7 if we only consider agriculture, *sensu stricto*. By adding the forest which also provides amenities to the inhabitants of the periurban fringes, it drops to 0.25 and it is only about 0.1, that is to say seven times lower than with agriculture only when other non man-made lands (fallow lands, natural areas and so on) are included as a source of amenities. We finally kept two values which seem likely: 0.25 corresponds to the average proportion of agriculture and forestland in periurban belts (about 80% of land) 0.1 corresponds to 90% of the periurban territory occupied by forest, agriculture and non man-made lands. The price obtained for amenities was expressed per hectare of amenity land or per household.

Figure 2 shows the results obtained in a fringe of 5 to 40 kilometres from the centre of a medium-sized city. The price of amenities expressed per hectare depends on the share of land considered as farmland in a ratio which goes from one to two depending on whether we keep 80 or 90% as well as the functional form chosen for the gradient of farmland rent (which, we should remember, was assessed only for the city of Dijon): the form is more convex with a Cox-Box transformation than with an exponential relationship (see for further information: "Urban Influences on Periurban Farmland Prices").

At all events, this price is significantly different from zero, which brings us to the conclusion that households attribute a positive value to the living environment in the periurban belt (about 40 kilometres). The price changes with the distance: it is divided by two when going from 5 to 7 km at the fringe of the periurban belt. This sensibility to distance is rarely taken into account by the valuation methods of non market goods.

Figure 2: Implicit price of rural amenities in the periurban area of medium-sized French cities[1]
according to the distance to city centre (€ per year and rural hectare)

Box Cox form 80% of farm lands
Exponential form 80% of farm lands
Box Cox form 90% of farm lands

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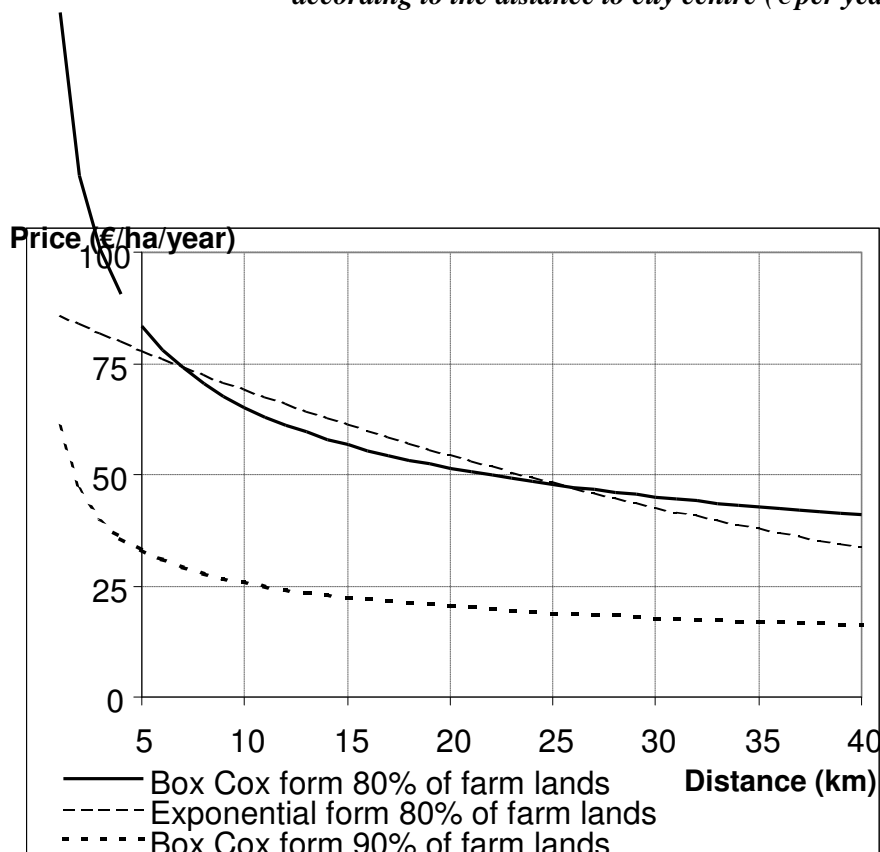
[1] These results concern the 23 urban areas of the centre-municipality which has 100 to 200,000 inhabitants, the land rents having been assessed for the particular case of Dijon, we suppose that it will not be different from the whole.

The median price of 50 Euros per year and per cultivated hectare (20 kilometres from the city and for 80% of agro-forest use of the land) only corresponds to a small fraction of the aid received by farmers, which, it is true, is not intended only for the remuneration of this externality. Maybe we could obtain higher values in highly populated regions (like Paris) or when the landscapes are more pleasant than the average periurban belt of a medium-sized city (vineyards, groves and so on); but in other regions, agriculture may produce more nuisance than amenities (off-soil livestock and so on).

At the same median point, the annual price that a household is willing to pay for periurban rural amenities is around 190 Euros, if they come from the 80% of the area occupied by agriculture and forest, or 75 € if we add the other non man-made lands as a source of amenities. The size of this second value is comparable to that obtained with other methods (contingent value, hedonic prices). The first is higher, which may be explained by the fact that here we are considering residential amenities which have a higher price than that of recreational amenities, consumed more occasionally. For a detached house worth around 100,000 Euros in the Dijon periurban belt, the capitalized amenities at a rate of 5% would be within a bracket from 1.4 to 3.5% of the value of a house, depending on whether we keep the first or second price that a household is willing to pay annually.

Jean Cavailhès, Dominique Peeters, Jacques-François Thisse
(INRA, UMR CESAER, Dijon) (Université catholique de Louvain Département de Géographie, CORE et CERAS, Paris)

For further information:
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