Decoupled Payments and the Localization of Activities[1]

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Abstract

This article considers the impacts of (de)coupled farm sector support on the locations of farming and agro-industrial activity. An economic geography model is developed which has two types of regions, one with extensive agricultural production (rural), the other with intensive farming that is more densely populated (urban). The farm and agro-industrial sectors are vertically linked. A service sector that is not directly linked to either basic industry is also explicit. We show that coupled and decoupled subsidies affect the spatial distribution of farming, industry, and service sector activity. Support that is provided to all farmers regardless of crop, thus semi-decoupled, increases spatial agglomeration. Support targeted to farmers of particular crops, especially rural comparative advantage crops, favors increased farming in rural areas but spatial agglomeration of non-farm activity still occurs. This latter targeting approach is used in the European Union.

Keywords : location, agriculture, economic geography, decoupling

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Introduction

The WTO negotiations specify that support for European agriculture should be more decoupled. Relative to the direct payments system established by the 1992 EU reform of the CAP, a system of subsidies to farm input users regardless of the type of output produced would be more decoupled (Swinbank, Tangermann, 2001). While such payments would be proportional to, for example, land used, they should not influence the farmer's choice of which products to supply. We call this kind of payment semi-decoupled.

This paper compares the effects of coupled and semi-decoupled payments to farmers on the location of agri-food activities. The ultimate objective of the paper is to determine which form supports the most dispersion of economic activity. If decoupling promotes dispersion, this may favor rural and regional development in the European Union. To address this issue a rural-urban economic geography model is developed and applied to simulate activity locations under the alternative policy regimes.

We are interested in the determinants of the location of agri-food activities between rural areas and high population density areas. The latter are not urban areas *stricto sensus,* but areas that also have agricultural activity, such as Netherlands, Denmark, Luxembourg or Belgium. Some high population density areas contribute significantly to European agricultural product. Areas adjacent to urban centers like the north of France, the east of England, or Catalonia are also this kind of high density area with farming. Our stylization of 'rural' areas, in contrast, reflects the situations of low population density areas where farming is even more important, like Ireland, some French and Spanish regions, Sweden, and Finland (Appendix 1). The peripheral low population density regions have the more notable rural development problems.

In this context, we show the effect of the mode of allocation of direct payments to farmers on the levels of land use by farms in rural and urban areas, and on the relative concentration of all economic activity. The model distinguishes two types of regions, rural and urban, and three types of industry: agriculture, agri-food industry, and other activity not directly related to agriculture, like services and other manufacturing. Farms and agri-food firms are vertically linked.

Although there is no other economic geography model analysis of the impact of agricultural policies on the location of activities, there are some analyses of the impact of public policies on the location of economic activity. Trionfetti (1997) shows that geographically targeted public expenditures can be a dispersive force in a core-periphery framework. In that model, public support augments demand. The share of public expenditures spent on domestic rather than imported products is parametric. Martin and Roger (1995) show that public expenditure on infrastructure which decreases interregional transport costs favors the agglomeration of activities. A reduction in transportation costs facilitates access to larger market areas. Firms trade low transport costs for larger fixed costs and internal scale economies. External scale economies encourage firms to agglomerate.

In the Martin and Roger model (1995), public policy doesn't directly affect the productivity of firms. Charlot (1999) made this choice. She analyzes the impact of geographically targeted public expenditures which modify firm productivity on the location of economic activity. She showed that public expenditures which reduce fixed costs are less effective at encouraging a dispersal of activities than expenditures that reduce variable costs.

In the model presented here consumers have preferences over both generic and varietal products. This is an abstract representation of the situation in Europe, as opposed to the situation in the United States where farm and food products are relatively homogeneous

(Kilkenny, Daniel, 2000). In the economy we describe, food products are either generic, or, vary according to the firm and the source of the raw agricultural input. These differentiated products have identifiable geographic origins.

We model the distance between geographic regions as discrete and transport of both farm outputs and final goods is costly (as in Kilkenny, 1998). Furthermore, we model farmers as proprietors of farm land. Returns to agriculture include both the return to farm labor and the return to farm land. Household income is taxed to finance any farm subsidies (as in Walz, 1996).

We treat all agricultural outputs as inputs to some agro-industrial activity, that is, we model farm products as intermediate goods. Krugman and Venables (1995), and Venables (1996) introduced vertical relations between industries in economic geography models in which workers are not mobile interregionally. Thus, the locations of industry are determined in part by the exogenous spatial distribution of employees and the endogenous effect of spatial concentration of employers on wages. The vertical relations between industries impart an additional force favoring agglomeration, especially when the costs of intermediate goods transport are high. While the assumption that labor is geographically immobile is appropriate for analyzing international trade, it is not applicable for interregional analyses (Ottaviano and Puga, 1997).

In our model, labor is costlessly mobile between farm, industry, and service sectors as well as geographically. As consumers, they spend their income on generic foods, local and non-local varietial food products, and locally provided services. The varietal products are differentiated by the geographic origin of the raw agricultural input as well as the location of the processing firm are called AOC (Appellation d'Origine Contrôlée). We should note that the differentiation of products according to their origin can be a marketing strategy even in the absence of AOC regulations or institutions.

While we will assume that labor is geographically and intersectorally mobile, the factor of production specific to agriculture, land, is by definition geographically immobile. Factor immobility can undermine the potential gains from trade: if resources cannot reallocate, some resources earn rents while others may be unemployed. Since von Thunen, we have known that the facts that labor is mobile, goods are not costlessly transported, and land is immobile, leads to two fundamental spatial outcomes. One, population and footloose productive activity concentrates in cities to minimize transport costs. In addition, external agglomeration economies that attract mobile households to concentrate in urban areas can leave rural land idle and rural household income low. Two, land use values decline with distance from population or market centers. Places can be so distant from market centers that even though they may be endowed with a relative abundance of the factor used intensively in farm production (land) they cannot enjoy a competitive advantage in agriculture (nor any other activity). Farm land immobility provides a justification for rural and agricultural sector policies (Boussard, 1996, Stiglitz, 2000).

Helpman (1998) models a mobile work force relative to immobile local supplies of housing (land). In his model, rent is determined as local expenditure on housing divided by local housing supply. He assumed that expenditure on housing is a fixed share of local income, which includes the local population's share of nationwide rent. In our model, land value is the residual share of sectoral value-added, as envisioned by Ricardo, Von Thunen, and Alonso (1964). Land rents are higher for high-priced products, high productivity land, or land closer (lower transport costs) to the market. Furthermore, land rent accrues only to farm households, in contrast with Helpman (1998) or Fujita and Krugman (1995), who distribute rents equally to all citizens everywhere. The perfect mobility of all households leads to equalization of real income per household income regardless of the household's region of residence or sector of employment. Since a portion of farm household income may be land rent, the return to farm labor can be less than the return to labor in other sectors.

Only total labor supply, regional land endowments, preferences, transport cost rates, and technology parameters are predetermined or exogenous. The model is a Walrasian general equilibrium system that is solved numerically. It permits us to conduct comparative static analyses of alternative stable, *asymmetric* spatial equilibria, in contrast with the majority of economic geography models based on Krugman (1991a, b). This is particularly appropriate for analyzing rural development policy. Mainstream new economic geography models relying on ad hoc closure rules generate either symmetric or fully concentrated equilibria (see, for example, Fujita, Krugman, and Venables, 1999).

Next, we present our hypothetical model of the spatial allocation of economic activity between two regions that stylizes the urban/rural dichotomy and agri-food sectors in the European Community (2). The model is applied to analyze the effect of the mode of farm subsidy provision on the distribution of economic activity, and rural development. We compare the effects of payments targeted to farmers according to generic products (e.g. coupled payments to maize or wheat farmers) to the effects of payments per farmer irrespective of their product (semi-decoupled) (3).

1 The Model

Vertical relations between sectors

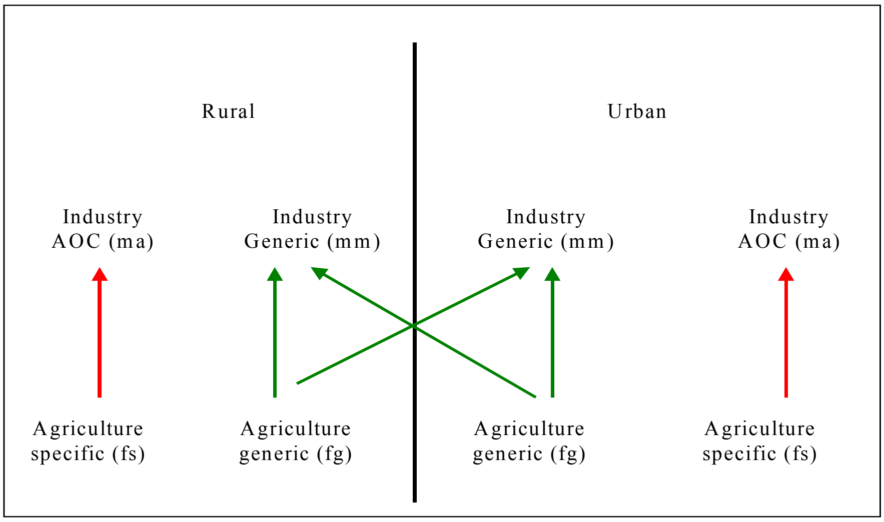
The model is designed to determine the equilibrium sectoral and geographic distribution of population and economic activity across two regions, 'rural' and 'urban', given consumer preferences, technology, and regional land endowments.[2] First we present our assumptions about endowments, the role of space and distance, and consumer preferences. Then we show how production and the various discrete choices, such as where to live, where to work, and whose products to buy, are formalized.

The community is composed of two regions with unequal endowments of land and population. The rural region has eighty percent of the country's arable land ($\varphi_{rural} = 0.8$). There are five types of industry (i or j) in each region: two farm sectors (generic or specific), two agro-industrial sectors (generic food commodities or AOC food), and a service sector. Generic farming (i = fg) in region (r) employs land ($T_{r,g}$) and labor ($L_{r,g}$). The sector supplies raw materials to generic processing (i = mm). That industry uses farm produce from any region. Specific farming (i = fs) employs land and labor to supply raw inputs into AOC processing (i = ma) in the same region only. This latter industry produces final consumer goods called "AOC" for this reason. The vertical links between sectors are presented in Figure 1.

The service sector (i=serv) employs labor at constant returns to scale to supply a homogeneous non-tradeable output (for local consumption only). There are ten types of households, distinguished by their region of residence (rural or urban) and the sectoral source of their income (generic or specific farming or manufacturing, or services).

[2] Agriculture is potentially present in urban areas. Thus, by urban we mean areas with lower proportions of the workforce in farming and higher population densities.

Figure 1 : Vertical relations between regional sectors



Transport costs are incurred on agricultural and processed products shipped from one region to the other. There is no cost of transport within regions. Transport costs are modeled in a form similar to the « iceberg » approach of Samuelson. This is formalized by the assumption that some of the product (labor) is used up in transit, so that the quantities delivered ($QD_{r,i,rr}$) are less than the quantities supplied ($QS_{r,i,rr}$) by the cost of transporting the product i from region r to region rr at the rate ($0 \leq \theta_{r,i,rr} \leq 1$)

$$QD_{r,i,rr} = QS_{r,i,rr} \, (1 - \theta_{r,i,rr}) \tag{1}$$

This implies that delivered prices (DP) must exceed mill prices (P) (ex. Beckmann and Thisse, 1986).

$$DP_{r,i,rr} = P_{r,i} \; / \; (1 - \theta_{r,i,rr}) \tag{2}$$

The numeraire is the urban specific agricultural product. Not only does this imply a "stable urban food price" monetary policy, it also is most tractable mathematically, since agriculture is a constant-returns-to-scale industry. Also, urban AOC products will always be demanded (given preferences shown in equation (5) below). Finally, material balance requires an equation of quantity produced ($Q_{r,i}$) to the quantities supplied ($QS_{r,i,rr}$) to all regions:

$$Q_{i,r} = \sum_{rr} QS_{r,i,rr} \tag{3}$$

And since the market for services is strictly internal to each region:

$$Q_{serv,r} = QS_{serv,r} \tag{4}$$

Household preferences are formalized by a Cobb-Douglas utility function over generic foods (c= mnf), AOC foods from their own region or imported (c = aocr, aocm), and services (c=serv) (5). Households are indexed by region and sector (*r,hh*) as explained above.

$$U_{r,hh} = \prod_c C_{c,r,hh}^{\alpha c} \tag{5}$$

Each type of final good (C_c) is a CES composite of manufactured products from the i food processing firms in the sectors where firm products are differentiated.

Regional prices of final goods are determined by market clearing. The material balance equations in each region equate the sum of each households' final demands ($C_{c,r,hh}$) to delivered industry supplies ($QD_{r,c,rr}$) where $L_{r,hh}$ is the number of households in each sector and each region, $\varsigma_{r,i,c,rr}$ aggregates the industrial goods into final goods, and N_{ri} is the (endogenous) number of firms in each industry :

$$\sum_{hh} C_{c,r,hh} L_{r,hh} = \left(\sum_{r,i} \varsigma_{r,i,c,rr} N_{r,i} QD^{\rho c}_{r,i,rr} \right)^{1/\rho c} \tag{6}$$

Agri-food firms that process generic products operate at constant returns to scale so there is only one "firm" in each region in that sector (N=1). The AOC firms produce varieties in a monopolistically competitive market. The number of firms (N) is endogenous given the optimal size of the firms (Q). The fixed cost of production (K) is the reason for internal increasing returns to scale in the AOC sector, and $L_{r,ma}=Q_{r,ma}+K$, or, $Q_{r,ma}= L_{r,ma}-K$. Freedom of entry implies zero economic profits. The optimal firm size is an exogenous function of fixed costs (K), the degree of substitutability between AOC varieties (ρ), and the input-output coefficient representing the technology of transforming raw agricultural inputs into AOC food products (ψ), (7)[3] :

$$Q_{r,ma}{}^{*} = \frac{K}{\frac{1}{\rho} + \frac{1}{\rho\psi} - \frac{1}{\psi} - 1} \tag{7}$$

Consequently, optimal employment in each AOC firm (L*) is :

$$L^{*} = K + \frac{K}{\frac{1}{\rho} + \frac{1}{\rho\psi} - \frac{1}{\psi} - 1} \tag{8}$$

Note also that the elasticity of substitution, σ= 1/1-σ ,is associated with the product, not the consumer. Thus both local and imported AOC varieties have the same elasticity of substitution. Given those preferences, the demand for AOC products facing each AOC firm is $QD = m \cdot DP^{-\sigma}$ where *m* is any positive constant and DP is the delivered price (sector and region subscripts dropped for simplicity). This means that in zero-profit equilibrium, all AOC firms everywhere use the same mark-up over marginal cost, and will be the same size everywhere.

Production technology in both agricultural sectors (i = f; f = fg or fs) is formalized by a Leontief function. This is a simplification compared to the situation where agriculture also enjoys returns to scale (Daniel, 2001).

$$Q_{r,f} = \min(L_{r,f}, T_{r,f}) \tag{9}$$

One unit of labor and one unit of land (by proper choice of units) is needed to harvest one unit of farm product. For example, one farm family on one 10 hectare farm produces one ton of grain. Thus, the marginal cost of production in farm sectors is the sum of the local farm wage ($w_{r,f}$) and the local farm land rent ($v_{r,f}$). The assumption that agricultural markets are competitive implies that the price received by the farmers (P) is this marginal cost when there are no subsidies(10).

$$w_{r,f} + v_{r,f} = P_{r,f} \tag{10}$$

[3] If there were no intermediate goods (ψ=0) the classic mark up over labor costs would obtain here.

Equation 10 also implies that land rents ($v_{r,f}$) are the residual of farm sector value-added at mill prices (subtracting transport costs) that is not distributed to mobile labor. Rents can also rise if land demand exceeds land supply in the region, but we do not assume the full employment of land. Where T∅ is the total amount of land in the community, and φ is (as defined above) the share of land in each region, land demand is constrained to be less than or equal to regional land available:

$$\sum_f T_{r,f} \leq \varphi_r \cdot T\varnothing \tag{11}$$

Wages are determined by local labor market clearing(12). Households that supply labor are, as discussed previously, intersectorally and interregionally mobile. We abstract from regional underemployment issues to focus on regional migration and thus agglomeration or dispersion.

$$LS_{r,i} = L_{r,i} \tag{12}$$

Farm household income is comprised of wages and rents, while non-farm household income consists solely of wages. Those non-farm wages also include the return to "capital" (K) in AOC sectors. If farm land rents are non-zero in a farm sector and region, returns to farm labor in that regional sector are lower than the returns to other labor in the region (by the amount of land rents). Where $N_{r,i}$ denotes the number of firms (or farms), w denotes the wage, and LS=L denotes the employees per firm, household income $YH_{r,i}$ is :

$$YH_{r,i} = N_{r,i}\left\lfloor w_{r,i}LS_{r,i} + v_{r,f}T_{r,f}\right\rfloor \tag{13}$$

Firms in the agro-alimentary industries employ labor and intermediate agricultural inputs (*I*) in constant proportions AOC firms also need labor to reproduce fixed costs (*K*). One unit of raw farm product is required to make $(1/\psi)$ units of processed food product, so $I_{fg,mm,r}=(1/\psi)Q_{r,mm}$ and $I_{fs,ma,r}=(1/\psi)Q_{r,ma}$. Given the input-output coefficient ψ, the production functions for generic and AOC foods are :

$$Q_{r,mm} = \min(L_{r,mm}, \psi \cdot I_{fg,mm,r}) \quad \text{and} \quad Q_{r,ma} = \min(L_{r,ma} - K, \psi \cdot I_{fs,ma,r}) \tag{14}$$

Total costs (*CT*) in each generic agro-alimentary firm are:

$$CT_{r,mm} = w_{r,mm}Q_{r,mm} + (1/\psi)\, Q_{r,mm}IP_{r,fg} \tag{15}$$

where $IP_{r,fg}$ denotes the delivered prices of generic farm inputs (a weighted average of the local and cross-hauled prices). The marginal costs (*Cm*) are

$$Cm_{r,mm} = w_{r,mm} + (1/\psi)\, IP_{r,fg} \tag{16}$$

The profit-maximizing levels of output are those that equate marginal revenue at mill prices (which is equal to Pρ for AOC processors, but is parametric for generic processors) to marginal cost :

$$P_{r,ma} = \frac{1}{\rho}\left(w_{r,ma} + \frac{1}{\psi}P_{r,fs}\right) \quad \text{and} \quad P_{r,mm} = w_{r,ma} + \frac{1}{\psi}IP_{r,fg} \tag{17}$$

Since generic farm inputs are perfect substitutes in generic agro-alimentary industry, processors will use whichever region's farm product is cheaper, or both regional products if their delivered prices are the same. This is formalized parsimoniously by a modified Kuhn-Tucker condition for interior or corner solutions (c.f. Kilkenny, 1998):

$$QD_{rr,fg,r}(DP_{rr,fg,r} - DP_{r,fg,r}) \leq 0 \tag{18}$$

Thus, the generic farm output from region rr will be demanded by firms in region r ($QD_{rr,g,r}$>0) if its delivered price is less than the delivered price of the local generic farm product, or, if the delivered prices are equal. The amounts demanded sum to the amount needed:

$$I_{fg,mm,r} = \sum_{rr} QD_{rr,fg,r} \tag{19}$$

Similarly, households will work as proprietors in a regional sector as long as they can obtain at least as high utility from the income they earn in that sector and location as they could elsewhere. This mobility is costless. The implication is formalized by another modified Kuhn-Tucker condition:

$$LS_{r,i}\left(U_{r,i} - U_{rr,j}\right) \geq 0 \tag{20}$$

As explained earlier (5), household utility is derived from the consumption of generic food, local AOC food, imported AOC food, and services. Given the budget share α, household income *YH*, delivered composite goods prices *CP*, and the number of workers per household type (*L=LS*), the demand for each composite good (*C)* is determined by:

$$\alpha_{c,r} YH_{r,hh} = C_{c,r,hh} CP_{c,r} L_{r,hh} \tag{21}$$

To verify that the solution of this system of simultaneous equations is a Walrasian equilibrium, one market-clearing equation must be solved implicitly. For example, in the following simulations, the market-clearing equation for the numeraire good, urban AOC, is dropped. The solutions shown below satisfy Walrasian general equilibrium conditions[4].

2 Direct Payments, land use, and the location of activity

The model above is completed by formalizing public policy and government finance. Government expenditure is financed by lump-sum taxes (g) on the entire working population, *L∅.* Agricultural subsidies (S_i) are provided per unit land used (T_{ri}). Given the labor force and the level of subsidy, the tax rate is endogenously determined to balance the government budget :

$$g \cdot L\varnothing = \sum_{r,i} S_i \cdot T_{r,i} \tag{22}$$

Since households pay head taxes, effective demand for consumer goods is reduced:

$$\alpha_{c,r}(YH_{r,hh} - g.L_{r,hh}) = C_{c,r,hh} CP_{c,r} L_{r,hh} \tag{21'}$$

Agricultural policy is defined according to the mode of payment distribution and the amounts. The rates of subsidy are pre-determined by the political process (exogenous to the economic model). We consider two modes of distribution. In the first case, only generic farm product producers are subsidized (scenario 1). The objective of this policy is to support primary producers of basic commodities to maintain low prices to consumers on necessities. The direct payments ($S_{r,fg}$) to generic producers are provided per farmer in farm sector fg. This is equivalently per unit output or per unit land used, given the fixed proportions production function. The subsidy raises the unit revenue received by farmers above the price paid by the

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[4] The assumptions of the baseline scenario as are follows. There are 100 units of labor, and 20 units of arable land in the whole community (L∅=100, T∅=20). The rural region has 80% of the farm land. Four units of raw farm product are needed per unit of processed food output (ψ=4). Interregional transport costs are 10% per unit shipped ($\theta_{r,rr}$=0,1). Fixed costs in the AOC sector (i=a) are K=0.1. Consumer preferences are such that 50% of their budget is spent on services, (α_{ser}=0,50), 25% on generic food (α_{mnf}=0,25), 16% on local AOC varieties, and 9% on non-local AOC food. The degree of substitution between AOC varieties is a relatively low σ_{aoc}=2. Between local and nonlocal generic foods it is σ_{mnf}=4. All other variables are endogenous and shown in the Social Accounting Matrix (Appendix 3).

generic processing industry. The unit revenue received by producers of specific farm outputs (fs) continues to reflect marginal cost:

Scenario 1 $$w_{r,fg} + v_{r,fg} = P_{r,fg} + S_{r,fg}$$

$$w_{r,fs} + v_{r,fs} = P_{r,fs} \qquad (10'\text{-}1)$$

The alternative policy scenario consists of a subsidy to any farmer regardless of agricultural product, also per farmer, unit output, or unit of land in cultivation. Relative to the first scenario this policy is more decoupled because it does not alter relative returns to farm land in different uses. This subsidy also raises unit revenues received by all farmers (f=fg,fs) above the unit prices paid by agro-alimentary industries:

Scenario 2 $$w_{r,f} + v_{r,f} = P_{r,f} + S_{r,f} \qquad (10'\text{-}2)$$

These two policy scenarios will lead to different spatial equilibria. They do not have the same effects on farm land use. A comparative static analysis of each scenario is conducted in reference to the base scenario without public intervention.

2.1 Support Coupled to Generic Farming

In this scenario support payments are targeted to generic farming. The level of support is modeled to provide about 40% of the gross revenue to producers, which is 0.4 per unit ($S_{r,fg}$=0,4) (Table 1: P_g = 0.998). The head tax necessary for government budget balance for this policy is found to be g=0.022.

The targeting of aid to generic farm production has characteristics of geographically-targeted aid. This is because all generic farming occurs in the rural region (none in the urban region) in the initial no-policy baseline scenario (Table 1).

This policy leads to a 6.7% increase in the number of persons engaged in generic farming in the rural region. Also, employment in the generic processing industries in both regions expands. The policy does not lead to any initiation of generic farming in the urban region. Rural wages rise (Table 2), so that region becomes less attractive to non-farm employers in both the AOC agro-alimentary and service sectors. The net effect of the increase in the rural farm population and the decrease in the rural non-farm population is that the total rural population falls slightly. Land used for the production of generic products increases, exclusively in the rural region. AOC production falls across the community because that farm sector (and the processing sector linked to it) becomes less competitive for land and labor relative to generic farming (and its processing sector).

Table 1: Scenario 1: Subsidy targeted to generic farming: Geographic and sectoral distribution of labor and land (percent change from no policy baseline)

		Rural			Urban		
Population and labor force		LO	L	L%	LO	L	L%
Farming	Generic	5.205	5.556	6.7	0	0	0
	Specific	1.305	1.275	-2.3	1.195	1.170	-2.1
Manufacturing	Generic	10.595	11.128	5.0	9.203	9.986	8.6
	AOC	11.742	11.471	-2.3	10.755	10.527	-2.1
Services		28.847	28.148	-2.4	21.153	20.740	-2.0
	Total	57.694	57.578	-0.2	42.306	42.423	0.3
Land		TO	T	T%	TO	T	T%
Farming	Generic	5.205	5.556	6.7	0	0	0
	Specific	1.305	1.275	-2.3	1.195	1.170	-2.1
	idle	9.49	9.169	-3.4	2.805	2.83	0.9
	Total	80%			20%		

Household utility with the policy, however, is slightly lower overall than without the policy (Table 2). This is because other than the existence of idle farm land, there were no other market failures in the reference scenario. And, the free market mix of goods brought more utility than the mix made available under government subsidy. Note also that while more land is brought into production, generic farm production in the urban region never becomes competitive with rural generic farm production, and about two thirds of the urban land remains idle.

Table 2 : Wages and Utility

	Subsidy	W0	W	W%	U0	U
Rural	0.4	0.998	0.999	0.1	0.234	0.233
Urban		1.000	1.000	0		

The coupled subsidy leads to a 8-9% reduction in the market price of generic foods consumed by households (Table 3), and a 36-40% reduction in the market prices of generic farm outputs. This indicates that consumer surplus captures about 100% of the support, given the subsidy-induced supply expansion. This result underscores that in the context of a mobile workforce and surplus or idle land, farmers do not capture the benefits of subsidies because they do not hold claims on a relatively fixed factor of production. Instead, taxpayers get back what they paid, less the utility lost due the distortion of the mix of goods available. All households pay equal taxes to finance the subsidies, and all households benefit equally from the lower food prices.

Table 3. Scenario 1: Aid Coupled to Generic Farming: Prices
(percent change relative to no policy baseline)

		Rural			Urban		
		P0	P	P%	P0	P	P%
Farming	generic	0.998	0.599	-40	1.233	0.790	-36
	specific	0.998	0.999	0.1	1.000	1.000	0
Industry	manufacturing	1.247	1.148	-7.9	1.277	1.166	-8.6
	AOC	2.495	2.497	0.1	2.500	2.500	0
Services		0.998	0.999	0.1	1.000	1.000	0

Thus we have shown that subsidies coupled to generic farm production, which was largely rural *ex-ante,* supports rural farm activity (but not rural population) expansion *ex post*. Subsidies that do not differentiate between types of farm output will support a more geographically even expansion of farm activity. Butas we show next, the two types of policies have the same overall effect on the locations of population and economic activity.

2.1 Subsidies Not Differentiated by Farm Land Use

In this scenario, subsidies are allocated to all farmers regardless of what they produce. Both types of farmers receive direct payments. The total amount spent by the community on agricultural support is set at the same level as the amount spent in Scenario 1. Thus, the subsidy per unit land used (per farm or per unit output) is lowered to 0.28, ($S_{r,f}$=0.28) which is about 30% of the initial gross revenue per unit. The budget neutrality of this scenario relative to scenario 1 implies that the per head tax necessary for government budget balance remains at g=0.022.

The subsidy raises farm wages (Table 5) because rents remain zero (the opportunity cost of idle land) and farm market prices (Table 4) do not change. This is because Urban AOC is the numeraire good—its price is fixed at unity to identify the price level in the Walrasian system, so wages (and or land rents) in Urban AOC production rise by the full amount of the subsidy. Labor mobility means all wages rise by the same amount or else the labor will out-migrate. Thus, generic farm wages also rise by the full amount of the subsidy, while all raw farm product prices remain unchanged from their initial levels (Table 4.) And the market prices of all final goods rise relative to the numeraire good, Urban AOC, because they now face higher costs of labor.

Table 4. Scenario 2 (Semi-decoupled) – Prices
(percent change relative to no policy baseline)

		Rural			Urban		
		P0	P	P%	P0	P	P%
Farming	Generic	0.998	0.998	0	1.233	1,233	0
	Specific	0.998	0.998	0	1.000	1.000	0
Industry	Manufacturing	1.247	1.528	22.5	1.277	1.557	21.9
	AOC	2.495	3.045	22.5	2.500	3.060	22. 4
Services		0.998	1.278	28.1	1.000	1.280	28

Table 5. Scenario 2 (Semi-Decoupled) : Wages and Utility

(percent change relative to no policy baseline)

	Subsidy	W0	W	W%	U0	U
Rural	0.28	0.998	1.278	28.1	0.234	0.235
Urban		1.000	1.280	28		

The change in nominal wages is slightly higher in the rural region than in the urban region (Table 5). This contributes to the localization of the generic food processing industry in the lower labor cost urban region. Furthermore, given the larger budget share of consumer spending on local AOC, the concentration of population in the urban region is matched by an increase in the level of urban AOC farming, processing, and service sector activity (Table 6).

The subsidization of agriculture and its expanded employment also leads to a reduction in employment in the sector that is neither directly nor indirectly linked to agriculture, the service sector. This mode of subsidy, in the context of vertically linked farm and manufacturing sectors, expands all except service sector activity. Land use expands in both regions (Table 6). The overall increase in factor use not accompanied by a distortion in the mix of available goods leads to higher household utility, community-wide (Table 7). The semi-decoupled policy also favors the same amount of population agglomeration in the urban region as the coupled policy.

Table 6 : Scenario 2 (Semi-Decoupled) Sectoral and Geographic Redistribution of Labor and Land Use

(percent change relative to no policy baseline)

		Rural			Urban		
Population and work force		LO	L	L%	LO	L	L%
Farming	Generic	5.205	5.361	3	0	0	0
	Specific	1.305	1.340	2.7	1.195	1.229	2.9
Industry	Manufacturing	10.595	10.818	2.1	9.203	9.563	3.9
	AOC	11.742	11.764	0.2	10.755	10.794	0.4
Services		28.847	28.282	-2	21.153	20.850	-1.4
	Total	57.694	57.565	- 0.2	42.306	42.436	0.3
Land		TO	T	T%	TO	T	T%
Farming	Generic	5.205	5.361	3	0	0	0
	Specific	1.305	1.340	2.7	1.195	1.229	2.9
	Idle	9.49	9.299	-2	2.805	2.771	-1.2
	Total	80%			20%		

This mode of subsidy brings more land into production everywhere. But because it does not change the relative returns between the traditional rural generic farm activity and the specific farming which occurs also in urbanized areas, so it does not countervail against urban agglomeration.

Conclusion

The model has provided asymmetric equilibrium geographic and sectoral distributions of farm land use, farm labor, and non-farm labor that depend on the mode of agricultural subsidy. All agents are geographically and sectorally mobile. The model is particularly relevant for the analysis of rural economic development. The explicit general equilibrium approach overcomes the tendency in most economic geography models to simulate the phenomena of total concentration of all economic activity in one region.

Given the prospects of increased decoupling of direct payments to agriculture, the simulations show the effects of more and less coupled payments. Support targeted or coupled to farmers of traditionally rural crops generates increased specialization across rural and urban areas. Both types of policies allow food prices to fall relative to non-food prices, in real terms. Subsidies targeted to generic farmers, however, allow those prices to fall relatively more.

Ex ante, since generic farm outputs have been produced in rural areas, support targeted to generic farmers is geographically targeted support. At the same time, there is a risk that such coupled support may encourage generic farming in areas where it has not occurred before. Coupled support of extensive farming also encourages agglomeration of population and activity in more urban areas where farming is intensive. On the other hand, it induces an increase in cultivated land use in rural areas.

The provision of subsidies regardless of farm product, called semi-decoupled here, also goes initially to rural areas, since that is where the majority of farming activity occurs. This policy also fails to stem the agglomeration of non-farm activities in urban as opposed to rural areas. The wage inflation associated with this policy appears to suggest that it favors urban regions. However, all households in all regions are better off in real terms, including farmers, under this policy than under the more coupled policy.

One objective of regional development policy is to reallocate or disperse economic activity across the community. According to our analyses, neither coupled nor semi-decoupled agricultural support policies appear to achieve that objective. In contrast, if the objective is to increase land use in rural areas, subsidies targeted to traditionally rural farm sectors can be effective.

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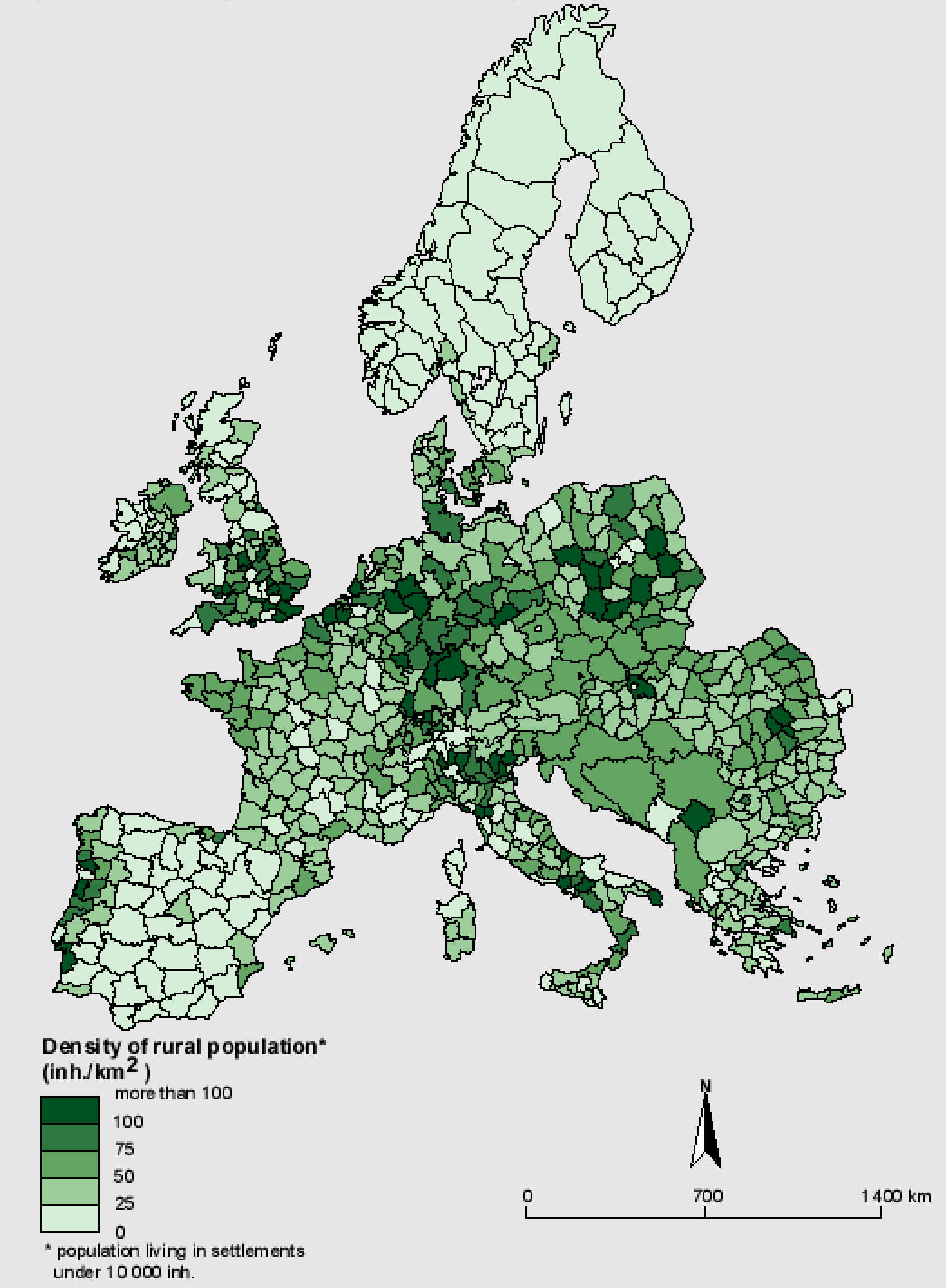
Appendix 1

FIGURE 2 - DENSITY OF RURAL POPULATION*



SPESP FRANCE - GDR LIBERGEO - EQUIPE P.A.R.I.S. Sources : Moriconi - Ebrard, Geopolis, 1994, et Eurostat.

Appendix 2. Equilibrium Firm Size (AOC Sector)

The first order condition for the problem of profit maximization is that marginal revenues equate with marginal costs. Total costs (*CT*) and total revenues (*Rev*) are:

$Rev = P_{r,ma} \cdot Q_{r,ma}$ and $CT = w \cdot L + P_{r,fs} \cdot I$

where L denotes labor, w denotes wages, $P_{r,fs}$ is the price per speicif farm input, and I is the amount of specific farm input used. The amount of labor is given by the production technology, given the need to reproduce fixed costs (K):

$L = Q_{r,ma} + K$

Given input-output coefficient ψ, the amount of inputs used is:

$I = (1/\psi) Q_{r,ma}$

Thus

$P_{r,ma} = (1/\rho)(w + (1/\psi))\, P_{r,fs}$

$P_{r,ma}\, Q_{r,ma} = w\, Q_{r,ma} + w\, K + w\, (1/\psi)\, Q_{r,ma}$

$\Leftrightarrow (1/\rho)\, (w + w/\psi)\, Q_{r,ma} = w\, Q_{r,ma} + wK + (w/\psi)\, Q_{r,ma}$

$\Leftrightarrow Q_{r,ma}\, ((1/\rho)(w + w/\psi) - w - (w/c)) = wK$

$$\Leftrightarrow \; Q_{r,ma}^{\;*} = \frac{K}{1/\rho + 1/\rho\psi - 1/\psi - 1}$$

Also, given: $Q_{r,ma}^{\;*} = L^* - K$

we have : $L^* = K + \dfrac{K}{1/\rho + 1/\rho\psi - 1/\psi - 1}$

Appendix 3 : Social Accounting Matrix (Base Scenario Solution)

	Rural fg	Rural fs	Rural mm	Rural ma	Rural serv	Rural hh	Urban fg	Urban fs	Urb. mm	Urban ma	Urb. serv	Urban hh	Total
Rural fg			2.643						2.551				5.194
Rural fs				1.302									1.302
Rural mm						8.572						4.643	13.215
Rural -ma						9.211						3.808	13.019
Rural-serv						28.785							28.785
Rural hh	5.194	1.302	10.572	11.717	28.785								57.570
Urban fg													0
Urban fs										1.195			1.195
Urb. mm						5.821						5.933	11.754
Urban ma						5.181						6.769	11.950
Urb. serv													21.153
Urban hh								1.195	9.203	10.755	21.153	21.153	42.306
Total	5.194	1.302	13.215	13.019	28.785	57.570	0	1.195	11.754	11.950	21.153	42.306	