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► To cite this version:

Douadia Bougherara, Carl Gagné, . Iowa State University. Is decentralization of agri-environmental policy welfare enhancing?. *Hearthland Environmental and Resource Economics Workshop*, Sep 2007, Ames, United States. 23 p. hal-01939963

HAL Id: hal-01939963

<https://hal.science/hal-01939963>

Submitted on 6 Jun 2020

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IS DECENTRALIZATION OF AGRICULTURE-ENVIRONMENTAL POLICY
WELFARE ENHANCING?

Douadia Bougherara

INRA, UR122, Rennes

Douadia.bougherara@rennes.inra.fr

Carl Gaigné^Y

INRA, UR122, Rennes

carl.gaigne@rennes.inra.fr

May, 10th 2007

Abstract

The purpose of this paper is to study how the decentralization of the agri-environmental policies affects social welfare. We develop a model of competition among jurisdictions where local governments seek to design and implement agri-environmental programs to maximize a local welfare function and where the residential choice of individuals is endogenous. From this framework, we find that the decentralization of the agri-environmental policy leads to (i) inefficiently low payment for the production of environmental goods from global welfare viewpoint and (ii) a rise of the consumer's welfare at the expense of farmer's income.

Keywords: conservation, residential mobility

JEL Classification: H23, Q10, H71

^Y Auteur correspondant : Carl Gaigné, INRA, UR122, Economie Rurale, 4 Allée Bobierre, 35000 Rennes. Tel : (33) 02.23.48.56.08. Fax : (33) 02 23 48 53 80. Email : gaigne@rennes.inra.fr

Bougherara D., Gaigné C., 2007, Is Decentralization of Agri-Environmental Policy Welfare Enhancing?, **Heartland Environmental and Resource Economics Workshop**, CARD, Iowa State University, September 16-17, Ames, Iowa.

1. Introduction

While the gains and losses associated with the decentralization of the provision of public goods has received much attention in public economics (see Rubinfeld, 1987, Scotchmer, 2002), rather little consideration has been given in the agricultural economics literature. Although EU and US agricultural policies have been characterized by centralization in the last decades, these policies experience an increasing move from an emphasis on agricultural production to more and more environmental and rural considerations. This is in fact a shift from sectoral policies to geographic policies and it offers as such new insights in the opportunity to decentralize agricultural policies.¹ The purpose of this paper is to study how the decentralization of the agri-environmental policies affects social welfare.

Because the environmental and rural benefits or harm can be localized and can differ among regions or counties, the devolution (or decentralization) of the agri-environmental policy is expected to promote a better allocation of public funds (see Gundersen *et al.*, 2004). For example, some local jurisdiction emphasizing environmental issues would

¹ The recent agri-environmental programs in US and EU indicate a move towards involving more and more local actors. The high variability of environmental assets, farming systems, institutional structure in each European country lead most countries to design agri-environmental contracts at a sub-national level. In US, in recent years, policymakers have created the Conservation Reserve Enhancement Program to focus a portion of the resources of the Conservation Reserve Program on local environmental problems. Similarly, local needs and priorities are reflected in the Environmental Quality Incentives Program which promotes agricultural production and environmental quality and provides incentive payments and cost-shares to implement conservation practices.

employ more set-asides of agricultural land than Federal programs (as in the US with the Conservation Reserve Program) while for other local jurisdictions, gains from a such policy are too weak relatively to its costs. However, the desirability of a decentralized environmental policy is more complex. We will see in this paper that, even though environmental benefits are localized, the decentralization of agri-environmental policy could be harmful.

Despite the wealth of literature on decentralization, and despite the obvious policy relevance of the subject, it is surprising that, to the best of our knowledge, no academic study has investigated the relative merit of the provision of agri-environmental goods at sub-national level². In local public economics, local aspects of the supply of public goods have been initiated by the seminal contribution of Tiebout (1956). In a world without distortions and with free mobility of individuals, Tiebout showed that a system of local governments providing services has an efficiency advantage over a more centralized system. According to Tiebout, competition among local jurisdictions to attract residents is welfare enhancing. The Tiebout model has been extended in different frameworks leading to different conclusions.

² There is a literature in environmental economics dealing with inter-jurisdictional competition deriving from the contribution of Oates (Oates, 1972. *Fiscal Federalism*. New York: Harcourt Brace.1972). The environmental federalism literature deals with the "race to the bottom" hypothesis where jurisdictions set non-stringent command-and-control environmental policies to attract firms. This model differs from ours in that it ignores positive externalities arising from spatially immobile activities and population mobility.

This paper develops a model of competition among jurisdictions where local governments seek to design and implement agri-environmental programs to maximize a social welfare function and where the residential choice of individuals is endogenous. The payment for the production of the environmental good raises the welfare of residents and is financed by a unit tax on mobile workers. The originality of our analysis lies on the fact that the public good (the environmental good) is not provided by the public sector but by the private sector (the agricultural sector) which allocates its resources between producing the local public good (the environmental good) with respect to the level of subsidy and producing the private good. By this way, we take into account the fact that US and EU agri-environmental policies are characterized by incentive payments and cost-shares which incite farmers to protect the environment, to provide environmental services and to maintain the countryside.

The paper is organized as follows. Section 2 introduces the model by describing the objective function of workers, farmers and governments. In section 3, we present the benchmark case where we determine the optimal payment to farmers for a unified government. Section 4 is devoted to the non-cooperative policy case. We determine household location in this case and compare the welfare in each region with the benchmark case. Our analysis suggests that *the decentralization of the agri-environmental policy leads to (i) inefficiently low payment for the production of environmental goods from global welfare viewpoint*

and (ii) a rise of the consumer's welfare at the expense of farmer's income. Section 5 concludes.

2. Model

Assume an economy with two regions, labeled A and B and two sectors: a farm sector (F) and an industrial sector (I). Because we wish to focus on the pure effects of the forces at play, we consider that regions are symmetric. The I-sector produces the numéraire under decreasing returns, using workers as the only input. The F-sector produces an agricultural good, using a single input and can also produce an environmental good. Without loss of generality, we assume that each region hosts a single farm. Workers are mobile between regions whereas farmers are immobile. This harmonizes with the characteristics of the farming sector where labor is often less mobile than average population. Mobility occurs rather in the long run when farmers install and when they retire. We denote by L the mass of workers in the economy and L_r the mass of workers living in region $r=A,B$. The spatial distribution of workers between regions is endogenously determined. The public sector consists of two governments providing a payment made directly to farms for producing a local environmental good and using a unit tax rate on wages of workers.

Workers and industrial sector

Workers have identical preferences. The utility of a worker living in region r is given by:

$$u_r = w_r - t_r + vE_r \tag{1}$$

where w_r , t_r and E_r are the wage, the unit tax rate and the stock of environmental good prevailing in region r respectively whereas ν is the preference for the environmental good. The empirical literature reveals that natural amenities or a higher ranking on the US Environmental Protection Agency's hazard ranking system for a region attracts migrants *ceteris paribus* (Clark and Hunter, 1992; Détang-Dessendre and Molho, 1999; Rupasingha and Goetz, 2004). Our framework could also apply to tourism where tourists would derive utility from activities in the region w_r (decreasing with the number of tourists because of congestion effects), and from consuming rural amenities E_r . But tourists would also experience a disutility from a tax to finance the rural amenities t_r . Empirical studies show that amenities from agricultural activities play a role on rural tourism thus attracting tourists (Vanslebrouck et al., 2005; Bonnieux et Rainelli, 2000). In addition, we assume there is no interregional environmental externality. In other words, the quantity of the environmental good prevailing in a region depends exclusively on the production of the environmental good in that region. We will see that, even though the benefits of the environmental output are limited to a jurisdiction, the decentralization of the agri-environmental policy can be welfare-reducing.

The technology in the industrial sector is identical in both regions. The production function is characterized by decreasing returns and is expressed as follows $y_r = \alpha l_r - \beta l_r^2 / 2$. The regional output markets are

perfectly competitive and there is no transport cost. The price is the same in each region and is normalized to 1. Similarly, regional labor markets are perfectly competitive. Consequently, the equilibrium wage in a region decreases with the mass of worker (*congestion effect*) and is given by

$$w_r^* = \alpha - \beta l_r \quad (2)$$

Let λ be the share of workers living in region A. A spatial equilibrium arises at $\lambda \in [0,1]$ when $\Delta U(\lambda) = U_A - U_B = 0$. By introducing (2) and (1) in $\Delta U = 0$, we obtain the equilibrium share of workers located in region A, given by

$$\lambda = \frac{1}{2} + \frac{\nu(E_A - E_B) - (t_A - t_B)}{2\beta l} \quad (3)$$

It is not surprising to check that workers have an incentive to locate in the region supplying the highest level of environmental goods and the lowest level of taxation. When there is no difference between regions, workers are identically distributed. Notice also that high sensitivity of the equilibrium wage to a change in the mass of worker favors the dispersion of workers between regions.

Agri-environmental production

In each region, each farmer produces an agricultural good under constant returns and is endowed with a fixed amount h of an input (labor or land). In what follows, we use labor as the input for producing the agricultural good. One unit of this good requires m units of labor. The price of this good p is exogenous and its marginal costs is c . We thus

consider individual farmers cannot influence commodity prices by their production choices.

Each farmer may also produce an agri-environmental good with the following technology:

$$E_r = 2\gamma\sqrt{h_r} - F \quad (4)$$

where $\gamma > 0$ is a measure of the farmer efficiency in agri-environmental production, $F > 0$ represents the threshold effect in agri-environmental production and h_r is the number of labor units dedicated to produce the agri-environmental good. Because of F , the production of this good requires a minimum amount of labor, given by

$$\bar{h}_r = \frac{1}{4} \frac{F^2}{\gamma^2} \quad (5)$$

With h the total mass of labor units a farmer is endowed with and h_r the number of labor units devoted to agri-environmental production and by considering (3), the profit function for a farm established in region r can be expressed as follows :

$$\pi_r = M(h - h_r) + \rho_r(2\gamma\sqrt{h_r} - F) \text{ with } M \equiv (p - c)/m \quad (6)$$

where M are the operating profits per labor unit arising from the production of the agricultural goods and ρ_r the payment received by the farmer for each unit of agri-environmental good.

The first order conditions characterizing the farmer' optimal choice ($\partial\pi_r/\partial h_r = 0$) implies that

$$h_r^* = \frac{\rho_r^2 \gamma^2}{M^2} \quad (7)$$

In other words, the mass of labor units dedicated in the production of the environmental good raises with the payment and the efficiency of the technology to produce this good (γ) and decreases with the operating profits per labor unit (M).

The farmer receives his payment if $E_r > 0$ that implies that $h_r^* > \bar{h}_r$ or, equivalently, by using (7) and (5) ,

$$\rho_r > \frac{1}{2} \frac{FM}{\gamma^2} \equiv \bar{\rho} \quad (8)$$

As a result, given (7), the profit function can be rewritten as follows:

$$\pi_r = hM + \frac{\gamma^2 \rho_r^2}{M} - \rho_r F \quad (9)$$

and the supply of agri-environmental good in region r is given by

$$E_r = 2 \frac{\gamma^2 \rho_r}{M} - F \quad (10)$$

It appears that the profits of each farmer increase with the payment as long as (8) holds.

Governments

The objective of each government is to maximize the following social welfare function

$$W_r = \theta \pi_r(\rho_r) + (1 - \theta) u_r(w_r, t_r, \rho_r) l_r \quad (11)$$

where θ is the weight of farmers in the social welfare function in each region. By using the budget constraint for each government, we know the

relationship between the unit tax rate and the payment for each farmer prevailing in each region:

$$t_r = \frac{\rho_r E_r(\rho_r)}{l_r} \quad (12)$$

Each government chooses simultaneously its payment for farmers ρ_r , taking as given the decision of the other government, and anticipating the farmer sector outcomes and the resulting location equilibrium of mobile workers (3). Hence, given the payments announced by the governments, farmers choose their quantity of agri-environmental good and workers choose their residential place. All players have a perfect information and the game is solved by a sub-game perfect equilibrium involving backward induction beginning with the last stage.

3. Unified government (benchmark case)

In order to identify the sources of potential inefficiency arising from non cooperative agri-environmental policies, we need the benchmark case characterized by the policy of a central government. In this case, the central government set a single payment (ρ) so that farmers have the same profits regardless of their location and the supply of the environmental good is identical in each region. Hence, the population is equally distributed between both regions and enjoys the same level of wages and tax rates. Hence, the total social welfare function is given by

$$W_T = 2\theta\pi + (1 - \theta)(w - t + vE)l \quad (13)$$

where $w = \alpha - \beta l / 2$, $\pi = hM + \gamma^2 \rho^2 / M - \rho F$, $E = 2\gamma^2 \rho / M - F$ and $t = \rho E / l$. The first order and second order conditions are given by, respectively

$$\frac{\partial W_T}{\partial \rho} = \frac{\gamma^2 [(1-\theta)\nu l + 2(3\theta-2)\rho] + (1-2\theta)FM}{M} = 0$$

$$\frac{\partial^2 W_T}{\partial \rho^2} = \frac{2\gamma^2(3\theta-2)}{M}$$

When $\theta > 2/3$, $\rho = \rho^{\max}$ where ρ^{\max} is such as $w - t(\rho) + \nu E(\rho) = 0$. Since farmers are highly favored in the welfare function, the more they are paid, the more their welfare. When $\theta < 2/3$, we obtain an interior solution given by:

$$\rho^o = \frac{1}{2} \frac{(1-\theta)\nu\gamma^2 l + (1-2\theta)FM}{\gamma^2(2-3\theta)} \quad (14)$$

Notice that $\rho^o > \bar{\rho}$ implies

$$\nu\gamma^2 l - FM > 0 \quad (15)$$

It is straightforward to check that the optimal payment increases with the preference for the environmental good (ν) and with the weight of farmers in the welfare function (θ). When θ is relatively high, the agri-environmental policy is implemented to raise the farmers' income. Such a result is expected. However, the impact of the parameters of the agricultural technology on the optimal payment depends on the value taken by θ . Table 1 reports the sign of the variation of the optimal

payment with respect to the characteristics of the agricultural technology and the preference of the government for each actor.

Table 1: Agricultural technology and optimal payment

		Agri-Environmental Production		Agricultural Production
Parameters of the agricultural technology		Efficiency	Fixed costs	Operating profits
Group favored in the social welfare function		$\partial \rho^o / \partial \gamma$	$\partial \rho^o / \partial F$	$\partial \rho^o / \partial M$
$\theta > 1/2$	Farmers	+	-	-
$\theta < 1/2$	Workers	-	+	+

Some comments are in order. When the farmers are favored, the central government does not encourage the production of environmental good when the technology to produce this good is specified by high fixed costs (F) or low marginal productivity (γ) and when the operating profits to produce the agricultural product (M) is high. In other words, a farmer receives more payments when its marginal productivity in the production of the environmental good is high when farmers have higher weight in the social welfare function.

Conversely, when the government favors workers, the payment is set in order to increase the production of environmental goods for workers' consumption when its technology induces high fixed costs (F) or low marginal productivity (γ). This leads to the following proposition.

Proposition 1. *Under a central government, the optimal payment increases with the (fixed and opportunity) costs of environmental production provided that the weight of farmers in the welfare function is not high. When the central government favors farmers, the optimal*

payment incite farmers to specialize in agri-environmental production when the environmental marginal productivity is high .

Such a result is obtained since no one but farmers benefit from the commodity output (the exogenous price does not appear in workers' choices). Workers value farming only as regards to the agri-environmental goods it supplies. So when workers are favored, agri-environmental production is encouraged whereas when farmers are favored, the payment aims at the production of the output that maximizes farmers' profits (agricultural or non-agricultural output).

Finally, at the optimum, the supply of agri-environmental good is expressed as follows:

$$E = \frac{(\nu\gamma^2 l - FM)(1 - \theta)}{M(2 - 3\theta)} \quad \text{with} \quad \frac{\partial E}{\partial \theta} = \frac{\nu\gamma^2 l - FM}{(-2 + 3\theta)^2 M} > 0$$

so that the quantity of agri-environmental goods increases with the weigh of farmers in the welfare function. However, the utility arising from the environmental policy is expressed as follows:

$$-t + \nu E \equiv \xi(\theta) = \frac{(\nu\gamma^2 l - FM)^2 (1 - \theta)(1 - 2\theta)}{\gamma^2 M l (2 - 3\theta)^2}$$

with

$$\xi(1/2) = 0 \quad \text{and} \quad \frac{\partial \xi}{\partial \theta} > 0$$

Hence it appears $\xi(\theta) \geq 0$ when $\theta \geq 1/2$. In other words, the farmers are always better-off when an environmental policy with payment is implemented whereas the workers cannot reach a higher level of utility,

except if the central government affects a higher weight to workers in the social welfare function. Hence,

Proposition 2. *Under a central government with utilitarian welfare function, the implementation of an environmental policy may not raise the welfare of workers.*

4. Non cooperative policies

4.1. Location of households with respect to the payments

By introducing (10) in (3), the spatial distribution of households depends on the payments and on the tax rates. However, tax rates vary also according to payments and the spatial distribution of workers (see (12)). Hence, $\Delta U(\lambda) = 0$ implicitly defines λ^* as a function of ρ_r . To simplify the subsequent developments, we capture the idea that the spatial allocation of households is influenced by the payments by taking a linear approximation of $\Delta U(\lambda)$, evaluated at the reference point $\lambda = 1/2$. Remember that regions are symmetric so that the spatial equilibrium will be given by $\lambda = 1/2$ *in fine* (local governments have the same behavior). Hence, we have

$$\lambda^* = \frac{1}{2} - \frac{2\gamma^2(\rho_A^2 - \rho_B^2)}{\beta l^2 M} + \frac{(FM + v\gamma^2 l)(\rho_A - \rho_B)}{\beta l^2 M} \quad (16)$$

the equilibrium spatial distribution of workers at the environmental policy given, with

$$\frac{\partial \lambda^*}{\partial \rho_A} = \frac{-4\gamma^2 \rho_A + FM + v\gamma^2}{\beta l^2 M} \quad \text{and} \quad \frac{\partial \lambda^*}{\partial \rho_B} = \frac{4\gamma^2 \rho_B - FM - v\gamma^2}{\beta l^2 M}$$

The function linking λ^* to ρ_A defines a bell-shape curve (see Figure 1). For low (resp., high) values of ρ_A , an increase in ρ_A pulls (resp. pushes) workers in region A. There are two effects that have opposite effects on λ : a *taxation effect* and an *environmental effect*. Indeed, on the one hand, when ρ_A raises, t_A increases leading to an outflow of workers: this is the *taxation effect*. On the other hand, an increase in ρ_A leads to a rise in E_A raising the utility of workers in region A as compared to workers in region B so that workers move to region A: this is the *environmental effect*. Finally, it appears that for a rise in payments from low values, the environmental effect dominates the taxation effect.

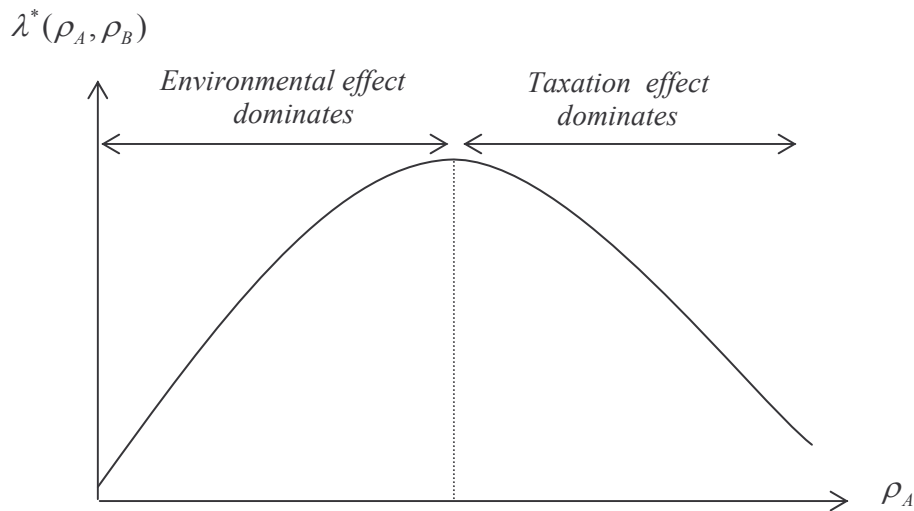


Figure 1. Residential location and payments

In addition, we have

$$\left. \frac{\partial \lambda^*}{\partial \nu} \right|_{\rho_A > \rho_B} > 0 \quad , \quad \left. \frac{\partial \lambda^*}{\partial M} \right|_{\rho_A > \rho_B} < 0 \quad \text{and} \quad \left. \frac{\partial \lambda^*}{\partial \nu \partial M} \right|_{\rho_A > \rho_B} < 0$$

When payment in region A is higher than in region B, a higher taste of workers for the environment attracts workers in region A ($\partial \lambda^* / \partial \nu > 0$) whereas higher operating profits arising from the production of the agricultural goods attracts workers in region B ($\partial \lambda^* / \partial M < 0$). The latter effect reveals the dominance of the taxation effect since an increase in M reduces the difference of environmental assets between region A and region B ($E_A - E_B$). But the increase in the number of workers in region A due to a higher taste of workers for the environment is a decreasing function of the operational profits arising from the production of the agricultural goods ($\partial \lambda^* / \partial \nu \partial M < 0$).

Finally, an increase in F attracts workers in the region with the highest level of payment. Indeed, F has no effect on the difference $E_A - E_B$. As a result, the environmental effect is higher when F achieve high values so that the agglomeration of worker is more likely to occur in the region with the higher payment.

To summarize,

Proposition 3. *In the non cooperative policy case, workers locate as a result of two opposite effects: (i) an attracting effect that is an environmental effect and dominates for low agri-environmental payments and (ii) a repulsive effect that is a taxation effect that dominates for higher agri-environmental payments.*

4.2. Nash payment vs. Optimal payment

Under this non cooperative configuration, each local government maximizes (11) with respect to ρ_r knowing (2), (9), (10), and (12) and anticipating the spatial equilibrium (16). The first order condition for region A implies

$$\frac{\partial U_A}{\partial \rho_A} = \theta \frac{\partial \pi_A}{\partial \rho_A} + (1-\theta) \left[\underbrace{\frac{\partial(w_A l_A)}{\partial \rho_A}}_{\text{Revenue Effect}} - \underbrace{\frac{\partial(t_A l_A)}{\partial \rho_A}}_{\text{Taxation Effect}} + \nu \underbrace{\frac{\partial(E_A l_A)}{\partial \rho_A}}_{\text{Environmental Effect}} \right] = 0$$

As a function of $(1-\theta)$, we identify three types of effects: a revenue effect, a taxation effect and an environmental effect. The taxation effect is negative whereas the environmental effect is positive. The revenue effect is ambiguous. Indeed,

$$\frac{\partial(w_A l_A)}{\partial \rho_A} = \frac{\partial l_A}{\partial \rho_A} \left(w_A + l_A \frac{\partial w_A}{\partial l_A} \right)$$

where $\partial l_A / \partial \rho_A$ cannot be signed as we have shown in the previous subsection.

The aim of our discussion is to compare the benchmark case (unified government) with the non cooperative configuration. Thus, instead of solving the program to find the optimal payment, we write first and second order conditions of government A program and analyze the sign of the first order derivative when the payment is equal to ρ^o , the optimal payment of the unified government (see (14)):

$$dI = \frac{\partial U_A}{\partial \rho_A} \Big|_{\rho_A = \rho^o} \quad \text{with } \rho^o = \frac{1}{2} \frac{(1-\theta)\nu\gamma^2 l + (1-2\theta)FM}{\gamma^2(2-3\theta)}$$

the results are to be interpreted as follows. If $dI > 0$ then $\rho_A^N > \rho^o$ and there is over-provision of environmental goods in the non cooperative game as compared to the unified government. If $dI < 0$ then $\rho_A^N < \rho^o$ and there is under-provision in the non cooperative game as compared to the unified government. Finally, if $dI = 0$, decentralized decisions are equivalent to centralized decisions.

Some calculations reveal that

$$\left. \frac{dU_r}{d\rho_r} \right|_{\rho_r=\rho^0} = \frac{\theta(1-\theta)[-(2-3\theta)(\alpha-\beta l)M - \nu(1-\theta)(\nu l\gamma^2 - FM)]}{l(2-3\theta)^2 M^2 \beta} < 0$$

Recall that $2-3\theta > 0$ and $\nu l\gamma^2 - FM > 0$ while $\partial^2 U_A / \partial \rho_A^2 < 0$ when $\rho_r = \rho^0$.

We find that $dI < 0$ then, regardless of θ , there is under-provision in the non cooperative game as compared to the unified government as stated in the following proposition:

Proposition 4. *A move from centralized agri-environmental policy to decentralized agri-environmental policy reduces the global welfare and the production of environmental goods.*

The decentralization implies the following interregional externality:

$$\frac{\partial U_s}{\partial \rho_r} = (1-\theta)(\nu E_s + \alpha - 2\beta l_s) \frac{\partial l_s}{\partial \rho_r}$$

The interregional externality may be positive, nil or negative depending on the sign of $(\nu E_s + \alpha - 2\beta l_s)$. At the unified government optimal

payment $\rho_r = \rho^0$, we know that $l_r = l/2$ and that $(\alpha - \beta l)$ is positive. Thus, in this case, the interregional externality writes:

$$\left. \frac{\partial U_s}{\partial \rho_r} \right|_{\rho=\rho^0} = (1-\theta) \underbrace{(vE_s + \alpha - \beta l)}_{>0} \frac{\partial l_s}{\partial \rho_r}$$

Starting from the configuration under which agri-environmental policy is centralized (so that $\rho_r = \rho^0$), a decentralization of this policy without coordination implies that each region has an incentive to diminish payments for each farmer and, in turn, the tax rate in order to attract more residents. Such a result emerges because ρ^0 belongs to the interval in which the environmental effect is dominated by the taxation effect (see Figure 2).

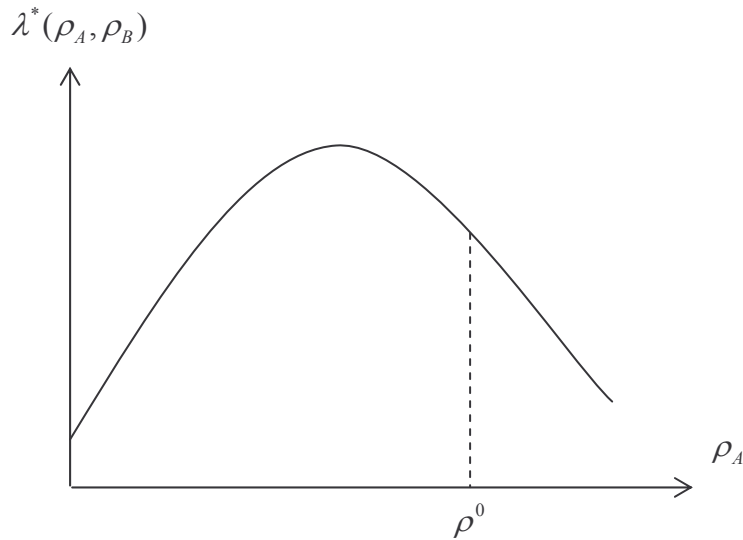


Figure 2. Residential location and optimal payment

Finally, we can conclude that the decentralization of the agri-environmental policy reduces (i) the global welfare regardless of the

weight of farmers in the social welfare function and (ii) the farmer's income. However, the effect of this decentralization on the workers' welfare is ambiguous. Some calculations show that

$$\left. \frac{\partial \xi(\theta)}{\partial \rho_r} \right|_{\rho_r = \rho^0} = -\frac{2\theta(v\gamma^2 l - FM)}{(2 - 3\theta)Ml} < 0$$

Hence, a fall in payment due to a move from centralization to the decentralization of the agri-environmental policy raises the welfare of workers. As previously, this result arises from the fact that ρ^0 belongs to the interval in which the environmental effect is dominated by the taxation effect. Hence,

Proposition 5. *A move from centralized agri-environmental policy to decentralized agri-environmental policy reduces the farmers' income and raises the workers' welfare.*

5. Conclusion

The aim of the paper was to consider the consequences of a decentralization of the agri-environmental policy in a context where natural amenities affect residential choices. We used a model with mobile population and governments subsidizing farmers for the production of agri-environmental goods. Our main result is that *the decentralization of the agri-environmental policy leads to inefficiency low payments for farmers from the global welfare viewpoint*. However, we also show that *while the farmer's income shrinks when decentralization*

occurs, the welfare of workers increases. Indeed, when decentralization takes place, each region has an incentive to diminish its payments in order to reduce its tax rate applied on residents to attract more inhabitants (and more tax base).

Our results are derived from given hypotheses and as such, our modeling is a first step. It should be noted that heterogeneities in residents' preferences and in farms' technologies could be easily introduced in our framework. However, our main result on the welfare impacts of the decentralization hold because the interregional externality identified in our analysis does not depend on the assumption of homogeneity in preferences and technologies.

One challenging issue is the spillover effects of non market good provision. When decentralization occurs, the choice of the quantity but also the quality of non market goods is left to the regions. Thus, a critical question is the endogenous choice of the type of agri-environmental good that will be optimally financed by regions. The spillover effects may be real in that residents' utility in region A is directly affected by the provision of agri-environmental goods in region B in line with transboundary pollution. But spillover effects may not be physical and play a role through preference only. For example, residents of region A may have a willingness to pay for existence values of ecosystems in region B. Such questions are left for further research.

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