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# A goal-framing approach to green payments' efficiency when vertical integration is an option

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**A goal-framing approach to green payments' efficiency when vertical integration is an option**

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**Abstract:**

This article explores farmer's decisions regarding the expansion of organic farming through intensive input use and the degree of in-house organic fertilizer production. Using a theoretical synthesis of two strands of the scholarly literature, namely pro-environmental norms and the goal-framing theory, the contribution of this article to the current literature is: (i) it redefines the concept of the crowding effects, which encompasses both changes in environmental preferences and in normative objectives; (ii) it points that the impact of a green payment on vertical integration depends on both the relative (i.e. the direction) and the absolute (i.e. the magnitude) size of the crowding effect being expected; (iii) it states that a trade-off between input use and vertical integration does always exist once a land subsidy is implemented, but not necessarily if a price premium is offered instead.

**Keywords:** personal and social norms, crowding theory, goal-framing theory, green payments vertical integration

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**JEL**: D91, Q18, Q58

## Introduction

According to a widely known postulate, economic incentives primarily correspond to, and influence, a self-centered rationality, otherwise known as rational egoistic motive or self-interest hypothesis (Ostrom 2000). Notwithstanding, it is well known that humans often reveal a variety of non-selfish motives, such as social approval and reciprocity (Fehr and Fischbacher 2002). Non-selfish motives are often considered to explore and explain voluntary contributions to a public good. In such a setting, Andreoni (1988) put forward the “impure altruism model” to explain the limitations of economic incentives. Brekke, Kverndokk and Nyborg (2003) propose the concept of “one’s self-image as a socially responsible person” in trying to define social approved motives. The latter bear close resemblance to what Bénabou and Tirole (2006) refer to it as reputational motive. However, the inability of (economic) incentives to accommodate motivational heterogeneity produces complex results and very often, is the main reason behind the ambiguity in ranking policy measures (Heyes and Kapur 2011).

The article focusses on farmers’ voluntary contribution to a public good, such as environmental quality. Farmers’ preferences play a crucial role in explaining the motivations towards environmentally friendly practices. In particular, these preferences encompass the moral commitments of agents (or as Sachdeva, Iliev and Medin (2009) put it the moral self-worth) and the social norms (compliance with prosocial behavior). In such a setting, incentives may induce partial and fragmented or even net crowding out of environmentally friendly attitudes. To our best knowledge, this paper joins for the first time, elements of different strands of the scholarly literature such as the Motivational Crowding Theory (MCT) (Frey and Jegen 2001) and the Goal-

Framing Theory (GFT) (Lindenberg and Steg 2007) with the well-established postulate of incentives driven rationality.

In this article, GFT is adopted as the basic framework for explaining farmer's production choices. Specifically, the purpose of this study is to examine how green payments, deployed by government and price premiums offered by consumers, affect farmers' decisions regarding the input use and the adaption of waste recycling and composting practices. The rationale of relying on GFT is that farmers may evaluate not only the outcome of their production choices, but also how this outcome is obtained (Frey, Benz and Stutzer 2004). Specifically, GFT encompasses goals as the psychological mechanism and hence, it is able to capture such dynamics in two dimensions: First, it integrates the concepts of values, norms and self-interest motives in a solid manner. Second, the concept of goals explains in a more consistent way the behavior of a producer, than MCT proposes. It is not that an external intervention perceived by a producer as controlling, but rather that it changes her goal hierarchy and hence, her production choices.

The novelty of our contribution is twofold: First, to our best knowledge, it is the first time that GFT is applied to production choices. Secondly, it brings new insights on the relative efficiency of different types of green payments. Frey and Stutzer (2006) propose that government subsidies have an ambiguous impact on intrinsic motivation. This study tries to shed some light on the conditions under which green payments undermines farmer's propensity to engage in waste recycling and composting practices.

By doing so, this article applies the aforementioned synthesis to the case of organic farming, a typical example of voluntarily contribution to public goods (i.e. environmental quality), and derives a set of novel results not previously identified in the relevant literature. In particular, the impact of a land subsidy on the expansion of organic farming depends jointly on the crowding in (out) possibilities and on the relative strength of the farmer's objectives[1]. Previous literature fails to identify such a result (see Jaime, Coria and Liu (2016)). In addition, a land subsidy always results in a trade-off between vertical integration (the in-house organic fertilizer production) and the expansion of organic farming. By stark contrast, such results are not necessarily valid when price premium is used as a policy instrument to enhance organic farming. It is known that consumers have a positively significant valuation associated with certified organic produce (Connolly and Klaiber 2014). The obtained results from this article may enable policy-makers to design more efficient policy interventions.

The structure of the paper is as follows. Next section presents the theoretical framework and examines the role of economic incentives to enhance organic farming and discusses the results. The final section concludes.

## Theoretical Framework

Consider a situation where a single farmer owns a piece of a land and produces an agricultural product, $q$. For simplicity, land is normalized to one and a single input production process is assumed. A typical example of such a single input is the amount of nitrate fertilizer, $x$. In particular, a farmer can use either conventional ($x_c$) or organic ($x_o$) fertilizers. By choosing a specific type of fertilizer, she primarily selects the type of farming system, and accordingly the *per-hectare* agricultural good is labeled as conventional ($q_c$) or organic ($q_o$). The following properties are assumed for the production process:

(1)
$$\begin{gathered} q_c(x_c) \geq q_o(x_o) \\ q_j' > 0 \quad and \quad q_j'' < 0, \qquad j = c, o \end{gathered}$$

Conventional and organic farming systems have two notable differences. First, an organic farmer may produce organic fertilizers by herself and thus, she can vertically integrate her farming system. There are many possible reasons why a farm chooses to vertically integrate its production. The most obvious one is to reduce the market dependence concerning the supply of inputs. Waste recycling and composting epitomize vertical integration choices (Galliou et al. 2018; Goncalves Da Silva et al. 2010). Beyond that, Hennessy (1996) explains the incidence of vertical integration as a farm response to informational externalities, an approach also employed by Vetter and Karantininis (2002a). In such a setting, vertical integration denoted by $k \in [0,1]$ reflects the percentage of own produced organic fertilizer. Consequently, producing $q_o$ units of the good costs $x_o w_o(k)$, such that $w_o(k) > 0$, $w_o' > 0$ and $w_o'' = 0$ for any $k \in [0,1]$. Specifically, $k = 0$ means that a farmer chooses to purchase all the necessary amount of the organic fertilizer from the market, and thus $w_o(0) > 0$ is the market price (i.e. unit cost) of organic fertilizer. On the contrary, $k = 1$ means that a farmer produces exclusively all the necessary amount of organic fertilizer and thus, $w_o(1) > w_o(0)$ represents the unit cost of in-house fertilizer production. In addition, the rationale of $w_o' > 0$ is that a decreasing marginal cost of in-house fertilizer production is unrealistic, since purchasing organic inputs seems to be the dominant strategy (Cobo et al. 2019). By contrast, the cost of producing a good conventionally is $x_c w_c$ where $w_c > 0$ denotes the unit price of conventional fertilizer.

Second, in-house production of organic fertilizer is a procedure, which further contributes to environmental quality since own produced organic inputs are associated with lower ecological footprint compared to the purchased ones (Goldstein et al. 2017). Thus, by choosing a specific degree of vertical integration, $k$, the environmental benefits from organic production are denoted by $b(k) > 0$, such that $b' > 0$ and $b'' < 0$. Notwithstanding, $k = 0 \Rightarrow b(0) > 0$ indicates that organic production, *per se*, has positive effects on the environment, even though the farmer chooses to purchase the whole amount of organic fertilizer, $x_o$ (van Huylenbroek et al. 2009).

A key element in our analysis is that it draws heavily on social psychology theories. To begin with, pro-environmental protection is perceived as a norm. Although the very meaning of a norm refers to a shared belief about what people ought to do, norm may have a variety of meanings in the jargon of social sciences, comprising both objective and subjective elements (Morris et al. 2015). A typical classification of norms distinguishes between social and personal norms (Thøgersen 2006). Nyborg et al. (2016) define social norm as " a predominant pattern of behavior within a group, supported by a shared understanding of acceptable actions and sustained through social interactions within that group." Viscusi, Huber and Bell (2011) emphasizes the first part of the previous definition where a social norm is seen as a normatively appropriate action, while (Elster 1989) underlines that a social norm is a rule of behavior that is enforced through social interactions (rewards and punishments).

By stark contrast, Vandenbergh (2004) perceives personal norm as a kind of obligation that is enforced through an internalized sense of duty and/or a guilt for failure to act accordingly. Often, personal norms are experienced as a sense of moral obligations (Steg 2016), so in the scholarly literature the term "moral norm" is used as a synonym with the personal norm (see Nyborg (2018)).

As Kalish (2012) argues norms guide social preferences, so it is often assumed that the strength of pro-environmental preferences depends on the interplay between personal and social norms (Harring and Jagers 2018). Suffice to say that the term "pro-environmental preferences" is a sub-category of the term "social preferences" used by Bowles and Polanía-Reyes (2012) which include, inter alia, altruism, reciprocity and ethical commitments. Formally, farmer's pro-environmental preferences, $\rho \geq 0$, are determined according to the following additively separable linear function:

$$(2) \qquad \rho(\beta) = \beta\rho^m + (1-\beta)\rho^{so}$$

where $\rho^m \geq 0$ denotes farmer's personal norm (i.e. her environmental morality), $\rho^{so} \geq 0$ denotes social norm (i.e. social pro-environmental preferences) and $\beta \in [0,1]$ is the *locus of causality* of environmental protection (De Charms 2013; Heider 1982). In particular, $\beta = 1$ means that a farmer feels that protecting the environment is her moral obligation and therefore, her environmental preferences reflect her environmental morality (i.e. $\rho(1) = \rho^m$). On the contrary, a $\beta = 0$ means that a farmer does not feel any moral obligation to protect the environment. Instead, any responsibility to act pro-environmentally comes from external pressure (i.e. social demand). Consequently, her pro-environmental preferences will reflect social norms (i.e. $\rho(0) = \rho^{so}$). A mixed case is possible as well in which farmer believes that protecting the environment is both her moral obligation and social demand.

Furthermore, we reject the standard, albeit implicit, separability assumption, under which the value of $\beta$ is fixed and unaffected by external incentives (Bowles and Polanía-Reyes 2012). In particular, this article assumes that the locus of causality is determined by the presence of various situational factors, $\boldsymbol{s} = (s_1, s_2, \ldots, s_n)$, often applied as subsidies or price premiums (thereafter, green payments)[2]. The stronger these payments are, the smaller is the influence of farmer's environmental morality upon her pro-environmental preferences. That is, $(\partial\beta/\partial s_i) < 0$ for any $s_i \in \boldsymbol{s}$.

The rationale is that green payments swift the locus of causality from inside (i.e. farmer herself) to outside (i.e. the payment itself) (De Charms 2013; Deci and Ryan 1985; Deci and Ryan 2008). Specifically, a green payment triggers a cognitive process by which a farmer tends to believe that she cares for environmental protection not because she is morally obliged, but rather because she is getting paid to do so. The higher a payment is, the stronger that feeling becomes and consequently, a smaller portion of her environmental morality (personal norm) will be reflected in her pro-environmental preferences (i.e. $(\partial\beta/\partial s_i) < 0$).

However, such a *crowding out effect* of personal norms on farmer's pro-environmental preferences does not necessarily imply that they are decreased as well. On the contrary, green payments have the potential to foster them, if social norms are strong enough. In particular, a differentiation of (2) with respect to a green payment $s_i$ yields:

(3) $$\frac{\partial\rho}{\partial s_i} = \frac{\partial\rho}{\partial\beta}\frac{\partial\beta}{\partial s_i} = (\rho^m - \rho^{so})\frac{\partial\beta}{\partial s_i}$$

and therefore, $(\partial\rho/\partial s_i) > 0 \Leftrightarrow \rho^{so} > \rho^m$. In words, the case which social norms dominate personal norms (i.e. $\rho^m < \rho^{so}$), emphasize the mighty role that perceptions concerning social approval and conformity have on shaping pro-environmental preferences. In such a setting, green payments enhance pro-environmental preferences $(\partial\rho/\partial s_i) > 0$, as they are perceived as impetus towards environmentally friendly adjustments. On the contrary, when personal (or moral) norms prevail over social norms (i.e. $\rho^m > \rho^{so}$), many people develop pro-environmental preferences, and analogous motivations, on the basis of moral commitment (Steg 2016). This create a general predisposition to devalue the role of green payments since they are not an internal part of a position build around the notion of moral obligation, and hence green payments seem to reduce pro-environmental preferences (i.e. $(\partial\rho/\partial s_i) < 0$).

In turn, according to the Goal-Framing Theory (thereafter GFT) developed by Lindenberg (Lindenberg 2001a; Lindenberg 2001b; Lindenberg 2006) and Lindenberg and Steg (Lindenberg and Steg 2007; Lindenberg and Steg 2013), farmer's production choices will be guided by three overarching goals: the gain goal (i.e. to improve her financial resources, status, etc.), the hedonic goal (i.e. to feel good, to enjoy herself) and the normative goal (i.e. to act appropriately). In the article's set up, for brevity and simplicity, the gain and the hedonic goals are merged into a single one, namely the non-normative goal.

In line with the prominent hypothesis of the GFT, the behavior of an individual is primarily influenced by that goal that it is in farmer's cognitive foreground (i.e. goal-frame) or otherwise known as focal (or central) (Lindenberg and Steg 2013). The elevation of a goal to a goal-frame status, depends jointly on farmer's preferences (i.e. on $\rho$) and on situational factors (i.e. on $\boldsymbol{s}$) (Lindenberg and Steg 2007). In this article, the strength of the normative goal is denoted by $\theta \in [0,1)$, such that $(\partial\theta/\partial\rho) > 0$, and the strength of the non-normative goal is denoted by $(1-\theta) \in (0,1]$, such that $(\partial(1-\theta)/\partial s_i) > 0 \Rightarrow (\partial\theta/\partial s_i) < 0$, for any $s_i \in \boldsymbol{s}$. The open upper bound of $\theta$ (resp. the open lower bound of $(1-\theta)$ means that by her nature a farmer always considers non-normative goals –gain and joy- and consequently, she will never base her decisions on a pure normative fashion.

The rationale behind the assumption $(\partial\theta/\partial\rho) > 0$ is that pro-environmental preferences are expected to frame normative actions, since they often considered to be legitimate social choice rooted in a feeling of normative obligation (Sabet 2014; Steg et al. 2016). On the contrary, green payments are expected to frame non-normative actions, and especially gain-related behavior, since they provide a direct way of improving farmer's personal wealth. Since there is a trade-off between normative and non-normative action, green payments push the normative goal into farmer's cognitive background (i.e. $(\partial\theta/\partial s_i) < 0$).

However, green payments also influence the impact of personal norms on farmer's pro-environmental preferences. In other words, green payments have a direct effect by framing non-normative actions, and an indirect effect through their influence on the degree of personal norm internalization. Therefore, the total impact of a green payment $s_i$ on farmer's normative goal preferences is:

(4) $$\frac{d\theta}{ds_i} = \frac{\partial\theta}{\partial\rho}\frac{\partial\rho}{\partial s_i} + \frac{\partial\theta}{\partial s_i} = (\rho^m - \rho^{so})\frac{\partial\theta}{\partial\rho}\frac{\partial\beta}{\partial s_i} + \frac{\partial\theta}{\partial s_i}$$

By defining $\zeta = -\frac{\partial\theta}{\partial s_i} / \frac{\partial\theta}{\partial\rho}\frac{\partial\beta}{\partial s_i} < 0$, a green subsidy induces normative goal preferences if $(\rho^m - \rho^{so}) < \zeta$. In addition, $\zeta$ may interpreted as the gap between the personal norms and social ones when normative objectives are unaffected by green payments (i.e. $(d\theta/ds_i) = 0 \Leftrightarrow (\rho^m - \rho^{so}) = \zeta$).

By using (3) and (4) we are able to redefine the concept of "crowding effects" in terms of how a green payment jointly affects farmer's pro-environmental preferences and normative actions (for details, see Appendix):

**Lemma 1:** *Any green payment, $s_i \in \boldsymbol{s}$ , bring about one of the following crowding effects:*

*(i)* *a pure crowding-in effect, where both pro-environmental preferences and normative goal preferences are enhanced:* $\{(\rho^m - \rho^{so}) < 0 \wedge (\rho^m - \rho^{so}) < \zeta\} \Leftrightarrow (\rho^m - \rho^{so}) < \zeta$.

*(ii)* *a pure crowding-out effect, where both pro-environmental preferences and normative goal preferences are reduced:* $\{(\rho^m - \rho^{so}) > 0 \wedge (\rho^m - \rho^{so}) > \zeta\} \Leftrightarrow (\rho^m - \rho^{so}) > 0$.

*(iii)* *a quasi-crowding-out effect, where pro-environmental preferences are enhanced, but normative goal preferences are reduced:* $\{(\rho^m - \rho^{so}) < 0 \wedge (\rho^m - \rho^{so}) > \zeta\} \Leftrightarrow \zeta < (\rho^m - \rho^{so}) < 0$.

In such a setting, the farmer's problem concerns the choice between input use and the degree of vertical integration. In what follows, a theoretical framework is proposed in which these choices are determined, based on farmer's procedural utility $u(x_o, k; \theta)$ (Frey et al. 2004).

*External interventions to foster organic farming - The case of economic incentives*

Let us assume a social planner who wishes to facilitate the expansion of organic farming by providing a land-based subsidy $s_l > 0$ (Andreoni and Bergstrom 1996) Such payment reflects society's acknowledgment for the provision of environmental benefits and belongs to a family of transfers known collectively as green payments (Horan and Claassen 2007) or payments for environmental services (Engel, Pagiola and Wunder 2008).

Beyond the regulatory policies, consumers are willing to pay a price premium, $s_p > 0$ for organic goods, on the basis that they perceive organic products as being differentiated products (healthier and more safe products) in comparison to the equivalent conventional produce (Endres 2007). Suffice to say that such a claim is primarily based on subjective perceptions (Apaolaza et al. 2018), whereas the majority of meta-analyses do not support any causality between food quality and/or food safety and organic produce (Benbrook 2013; Dangour et al. 2009; Magkos, Arvaniti and Zampelas 2006). However, beyond the self-centered rationality of consumers, it should be stressed that green consumerism often encompass ethical considerations (Kotchen and Moore 2008; Mazar and Zhong 2010). Notwithstanding, the latter is beyond the scope of this paper.

The price premium is only paid for goods certified as organic and sold under the analogous label. An independent third body, upon routinely inspecting farmer's compliance with organic farming prerequisites, issues such a certification. The fixed cost of such a certification denoted by $\psi > 0$ is assume to be borne by farmers. In its simplest case, such an eco-certification involve the identification of some traits in the production process, which are (imperfectly) correlated with the product's "environmental friendliness" (Mason 2011). The complex issues of random monitoring, uncertainty in signals and probabilistic certification are ignored in our analysis. The reader is referred to (Hamilton and Zilberman 2006) and (Mason 2013) for a thorough analysis.

*Incentives put forward by the Social Planner: the case of land subsidy*

In line with Frey et al. (2004), farmer's procedural utility of conventionally producing $q_c$ is

(5) $$u(x_c;\theta) = (1-\theta)[pq_c(x_c) - w_c x_c]$$

where the optimal input use is given by:

(6) $$x_c^* = argmax\{u(x_c;\theta), u(x_c^*;\theta) \geq 0\}$$

On the contrary, the procedural utility of a farmer who produces organically is:

(7) $$u(k, x_o;\theta) = (1-\theta)\left[\left(p+s_p\right)q_o(x_o) - x_o w_o(k) + s_l - \psi\right] + \theta b(k)$$

Likewise, the optimal input use and the optimal degree of in-house production of organic fertilizer are defined by:

(8) $$(k^*, x_o^*) = argmax\{u(k, x_o;\theta), u(k^*, x_o^*;\theta) \geq u(x_c^*;\theta)\}$$

where $(k^*, x_o^*)$ satisfy the first-order condition:

(9) $$\frac{\partial u(k, x_o;\theta)}{\partial x_o} = 0 \Rightarrow (1-\theta)\left[\left(p+s_p\right)q_o''(x_o^*) - w_o(k^*)\right] = 0$$

(10) $$\frac{\partial u(k, x_o;\theta)}{\partial k} = 0 \Rightarrow -(1-\theta)x_o^* w_o'(k^*) + \theta b''(k^*) = 0$$

Standard comparative statics (for details, see Appendix) reveals that the impact of a land subsidy on the optimal degree of in-house production organic fertilizer is:

(11) $$\frac{\partial k^*}{\partial s_l}\left[\frac{\partial\left(\frac{b'(k^*)}{w_o'(k^*)}\right)}{\partial k^*} - \left(\frac{1-\theta}{\theta}\right)\frac{\partial x_o^*}{\partial k^*}\right] = -\frac{x_o^*}{\theta^2}\frac{d\theta}{ds_l}$$

whereas its impact on the optimal input use is:

(12) $$\frac{\partial x_o^*}{\partial s_l} = \frac{\partial x_o^*}{\partial k^*}\frac{\partial k^*}{\partial s_l} = \frac{w_o'}{q_o''(p+s_p)}\frac{\partial k^*}{\partial s_l}$$

There are a number of worth-noting points in (11) and (12) that provide a number of implications: First, it is evident that $(\partial x_o^*/\partial k^*) < 0$ since $w_o' > 0$ and $q_o'' < 0$. Therefore, it is clear that $(\partial x_o^*/\partial s_l\ )$ and $(\partial k^*/\partial s_l\ )$ have opposite signs. The rationale behind such a result is that a land subsidy always triggers a trade-off between the expansion of organic production and the in-house production of organic fertilizer. Provide that the output is a monotonic and increasing function of the inputs used, a reduction in inputs produces a reduction in output, and *vice versa*. Therefore, a change in output may be attributed to changes in input intensity, known as intensive margin changes, and or to changes in cropping pattern, known as extensive margin changes (Fang and Rogerson 2009). However, the current modeling framework does not allow us to separate these two changes, since we assumed a single input production function. Therefore, in what follows we collectively refer to these changes as expansion or reduction, respectively, of organic farming[3]. In other words, land subsidies cannot simultaneously enhance vertical integration and the expansion of organic production. An increase of in-house production of organic fertilizer brings extra satisfaction to the farmer since she produces extra environmental benefits. The value of these benefits cancels off, at the margin, the product loss due to reduced inputs, and consequently $(\partial x_0^*/\partial k^*) < 0$.

Second, the sign of the term $[\cdot]$ of the LHS of (11) is specified by value of the ratio between non-normative and normative goal preferences. Specifically,

(13) $$[\cdot] > 0 \Rightarrow \frac{1-\theta}{\theta} > \hat{\theta} = \frac{\partial(b'/w_o')/\partial k^*}{\partial x_o^*/\partial k^*}$$

where $\hat{\theta} > 0$ denotes a threshold that shows the ratio between the speed that the environmental benefits increase as the degree of in-house production of organic fertilizer increases, over the magnitude of the trade-off between the expansion of organic farming and the degree of in-house production of organic fertilizer.

The implication of (11) and (13) is that crowding effects cannot solely determine the impact of a land subsidy on the optimal solution $(k^*, x_o^*)$. In order to be able to draw a picture on the effects of a land subsidy has on both input use and the expansion of organic farming, we must able to identify both the relative (i.e. the type of the crowding effect) and the absolute (i.e. the value of the ratio between normative and non-normative actions) size of the crowding effect. Formally (for details, see Appendix):

**Proposition 1:** *By using lemma 1 and (11), (12) and (13), it is proposed that a land subsidy: (i) triggers a trade-off between the expansion of organic farming and in-house production of organic fertilizer; (ii) induces in-house production of organic fertilizer if conditions C1 or C2 holds, where:*

*C1: {a pure crowding in effect is expected and* $(1-\theta)/\theta < \hat{\theta}$*}*

*C2: {a pure or a quasi-crowding out effect is expected and* $(1-\theta)/\theta > \hat{\theta}$*}.*

Figure 1 illustrates the impact of a land subsidy on in-house organic fertilizer production for different relative and absolute crowding effect. In particular, let's assume that before the introduction of a land subsidy a farmer has a ratio between normative and non-normative actions that corresponds to the point A. If a crowding-in expect is expected, proposition 1 states that a land subsidy induces in-house organic fertilizer production if the farmer moves to points C or D. On the contrary, if the crowding in effect is weak (i.e. movement from A to B), then a land subsidy induces only the expansion of organic farming. Following a similar reasoning, a farmer who was initially at the point D has an incentive to increase the in-house organic fertilizer production, if the crowding out or the quasi-crowding out effect is strong, such that to end in points A or B.

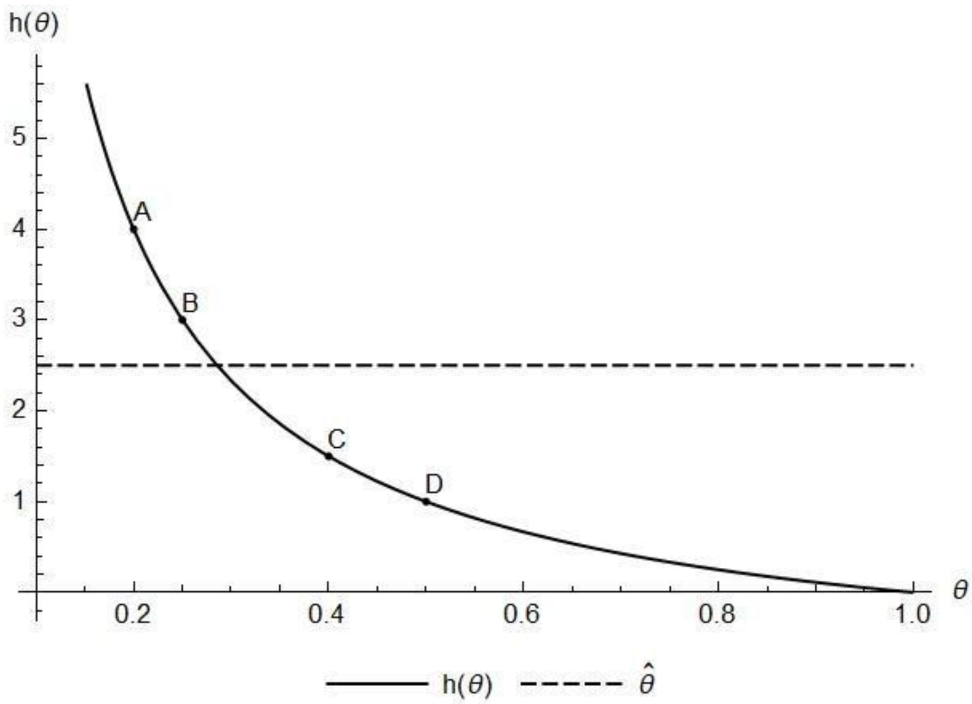


**Figure 1. In-house organic fertilizer production under a land subsidy**

To recapitulate, the effect of land subsidy on the expansion of organic farming simultaneously depends on the crowding in (out) possibilities and on the relative strength of the farmer's objectives. From the cases characterized above, it seems that the interplay between social and personal norms with the hierarchy of individual goals is rather complex.

*Incentives driven by consumers' choices: the case of price premium*

This section examines how price premium affect farmer's decisions regarding the input use and the degree of in-house organic fertilizer production. The impact of a price premium, $s_p$, on the optimal solution, $(k^*, x_o^*)$ is assessed by differentiating the first-order conditions with respect to $s_p$. It turns out that the relationship between price premiums and the optimal degree of in-house organic fertilizer production is given by (see Appendix for the proof):

$$(14) \qquad \frac{\partial k^*}{\partial s_p}\left[\frac{\partial\left(\frac{b'(k^*)}{w_o'(k^*)}\right)}{\partial k^*} - \left(\frac{1-\theta}{\theta}\right)\frac{\partial x_o^*}{\partial k^*}\right] = -\left[\left(\frac{1-\theta}{\theta}\right)\frac{q_o'}{q_o''(p+s_p)} + \frac{x_o^*}{\theta^2}\frac{d\theta}{ds_p}\right]$$

whereas the total impact of a price premium on the optimal input use is:

$$(15) \qquad \frac{\partial x_o^*}{\partial s_P} = \frac{\partial x_o^*}{\partial k^*}\frac{\partial k^*}{\partial s_p} - \frac{q_o'}{q_o''(p+s_p)}$$

Equation (15) points that a price premium affects input use both directly and indirectly. Specifically, the term $-(q_o'/q_o''(p+s_p)) > 0$, since $q_o' > 0$ and $q_o'' < 0$, reflects the direct impact, whereas the term $(\partial x_o^*/\partial k^*) \times (\partial k^*/\partial s_p)$ reflects the indirect one, the sign of which depends on $(\partial k^*/\partial s_p)$. The purpose of this direct impact is twofold: From one side it enhances any positive indirect impact and at the same time, it mediates the negative influence of the indirect one. The implication is that the presence of this direct impact does not necessarily trigger a trade-off between optimal input use and the optimal degree of own-produced organic fertilizer. Specifically,

$$(16) \qquad \frac{\partial x_o^*}{\partial s_p} > 0 \Leftrightarrow \frac{\partial k^*}{\partial s_p} < \frac{q_o'/q_o''(p+s_p)}{\partial x_o^*/\partial k^*}$$

where the RHS of it is positive, since both the nominator and the denominator are negative. In particular, (16) highlights that a price premium induces input use (i.e. $(dx_o^*/ds_p) > 0$) in two cases: If it reduces in-house organic fertilizer production (i.e. $\left(\partial k^*/\partial s_p\right) < 0$) or if it enhances in-house organic fertilizer production (i.e. $\left(\partial k^*/\partial s_p\right) > 0$), but such a positive effect is weak.

Furthermore, the RHS of (14) becomes positive if:

$$(17) \qquad \left(\frac{1-\theta}{\theta}\right)\frac{q_o'}{q_o''\left(p+s_p\right)} + \frac{x_o^*}{\theta^2}\frac{d\theta}{ds_p} < 0 \Rightarrow \frac{1-\theta}{\theta} > \tilde{\theta} = -\frac{q_o''\left(p+s_p\right)}{q_o'}\frac{x_o^*}{\theta^2}\frac{d\theta}{ds_p}$$

Note that the sign of $\tilde{\theta}$ depends on the sign of $d\theta/ds_p$. In particular, if a crowding out effect or a quasi-crowding out effect is expected, then $\tilde{\theta} < 0$, and consequently (17) holds. On the contrary, if a crowding in effect is expected, then (17) is satisfied, if the value of $\tilde{\theta}$ is relatively low. Such a situation arises if the crowding in effect is weak or if the direct impact a price premium on input use is rather strong. In addition, the term $[\cdot]$ of the LHS of (14) is positive if $((1-\theta)/\theta) > \hat{\theta}$. Thus, by using lemma 1 and (14), (16) and (17) it is proposed that:

**Proposition 2:** *The introduction of a price premium triggers the following effects: (i) enhances both input use and in-house organic fertilizer production, if* $\left(\partial k^*/\partial s_p\right) > 0$*, but not too high; (ii) it enhances in-house organic fertilizer production if conditions C3, C4 or C5 holds, where:*

*C3: {a pure crowding out or a quasi-crowding out effect is expected and* $((1-\theta)/\theta > \hat{\theta})$*},*

*C4: {a pure crowding in effect is expected,* $((1-\theta)/\theta > \hat{\theta})$ *and* $((1-\theta)/\theta > \tilde{\theta})$*},*

*C5: {a pure crowding in effect is expected,* $((1-\theta)/\theta < \hat{\theta})$ *and* $((1-\theta)/\theta < \tilde{\theta})$*}*

A comparison between propositions 1 and 2 points that in cases where a pure crowding out or a quasi-crowding out effect is expected, farmer's responses towards in-house organic fertilizer production are independent from the type of the payment (land subsidy or price premium) being offered (condition C2 on land subsidy is exactly the same with C3 on price premium). However, the situation becomes more complex when crowding in effect are expected instead. For instance, C5 is stricter than C1, since it also requires that $((1-\theta)/\theta < \tilde{\theta})$. If it is not true, then a "paradox" arises in which land subsidies induce in-house of organic fertilizer production, whereas price premiums undermine it. The policy implication is that the type of a green payment being offered may matters, once pure crowding in effects are expected. This "paradox" is illustrated in Figure 2.

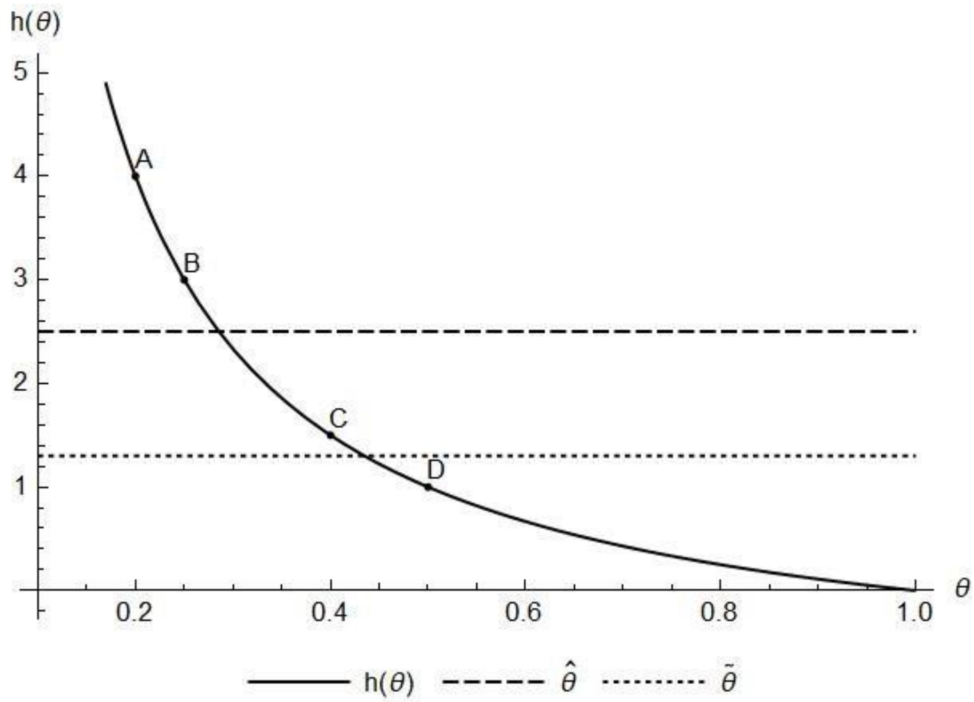


**Figure 2. In-house organic fertilizer production under a price premium**

In particular, figure 2 points the following: Let's assume again that initially a farmer is at point A. If a pure crowding in is expected, then any movement to points C or D will induce in-house organic fertilizer production, as long as a land subsidy is offered. On the contrary, if a price premium is implemented, then proposition 2 points a farmer has an incentive to increase the degree of in-house organic fertilizer proposition if the crowding in effect is ether weak (from A to B) or if it is quite strong (from A to D). For an "intermediate" crowding in effect (from A to C), the "paradox" arises. Importantly, a movement from A to B also increases the input use (see (16)), a feature of price premiums that it is absent in land subsidies.

## Conclusion

This article explores farmer's decisions regarding the expansion of organic farming through intensive input use and the degree of in-house organic fertilizer production. Using a theoretical synthesis of two strands of the scholarly literature, namely pro-environmental norms and the GFT, the contribution of this paper to the current literature can be summarized in the following: First, it redefines the concept of the crowding effects, which encompasses both changes in environmental preferences and in normative preferences. Second, it shows that the impact of a green payment on in-house organic fertilizer production depends on both the relative (i.e. the direction) and the absolute (i.e. the magnitude) size of the crowding effect being expected. Third, the model presented here points that the trade-off between the expansion of organic farming and in-house organic fertilizer production does always exist once a land subsidy is implemented. However, such a situation does not necessarily arise in cases where price premiums are offered. Specifically, a price premium can foster both input use and the degree of in-house organic fertilizer production if its impact on the latter is not substantial high (proposition 2, (i) or (16)).

However, the novelty of this article lies on the observation that for a given crowding effect, land subsidies and price premiums do not necessarily have the same influence on farmer's behavior. Specifically, the model presented here suggests that when a pure crowding out or a quasi-crowding out effects is expected, then farmer's behavior is independent from the type of the green payment being offered. The sufficient condition for a positive effect on the degree of in-house organic fertilizer production is that the ratio between non-normative and normative actions to be substantial high (see proposition 1, C2 and proposition 2, C3). On the contrary, the situation is far more complex when crowding in effects are expected, especially when price premiums are offered. In this article we illustrated that green payment requires a stricter set of conditions than land subsidies, making more likely for a “paradoxical” situation to occur. Thus, the policy implication is that when pure crowding in effects are expected due to the introduction of a green payment, then the type of that payment matters.

At last, few words about the main limitations of this paper are necessary. First, the present analysis is static, in terms of both time horizon and agent’s heterogeneity. Usually, environmental improvements come much later than their associated costs. Thus, time could affect how a farmer forms her normative and non-normative goal preferences, making in that way an important determinant of farmer’s decisions. Also, in terms of heterogeneity we implicitly assume that every farmer has the same response function to green payments, meaning that every farmer form both her pro-environmental preferences and normative preferences in the same way. In reality however, each farmer may has a unique response to external interventions and thus, heterogeneity might be a fruitful area for future research. Finally, this article neglects any interaction between farmers and also, it neglects the impact of policy menus. Future expansions of the present study can overcome these limitations.

**Notes**

[1] The issue of slippage has been ignored in this paper. See Lichtenberg and Smith-Ramírez (2011) for a thorough analysis.

[2] These situational factors can include other types of interventions, like legislation, taxation, information-based strategies and other type of incentives. However, in this article we limit our analysis only on monetary incentives and especially, on subsidies and on price premiums.

[3] Technically, such an assumption is equivalent to a zero elasticity of input substitution.

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## Appendix

*Proof of Lemma 1:*

Since $(\partial\beta/\partial s_i) < 0$, (3) states that: (i) $(\rho^m - \rho^{so}) < 0 \Rightarrow (\partial\rho/\partial s_i) > 0$; (ii) $(\rho^m - \rho^{so}) > 0 \Rightarrow (\partial\rho/\partial s_i) < 0$; $(\rho^m - \rho^{so}) = 0 \Rightarrow (\partial\rho/\partial s_i) = 0$. In addition, given that $(\partial\theta/\partial s_i) < 0$ and $(\partial\theta/\partial\rho) > 0$, we define $\zeta = -\frac{\partial\theta}{\partial s_i} / \frac{\partial\theta}{\partial\rho}\frac{\partial\beta}{\partial s_i} < 0$. Hence, (4) states that: (i) $(\rho^m - \rho^{so}) < \zeta \Rightarrow (d\theta/ds_i) > 0$; (ii) $(\rho^m - \rho^{so}) > \zeta \Rightarrow (d\theta/ds_i) < 0$; (iii) $(\rho^m - \rho^{so}) = \zeta \Rightarrow (d\theta/ds_i) = 0$.

Thus, a green payment: (i) induces both pro-environmental and normative goal preferences if $\{(\rho^m - \rho^{so}) < 0 \ and \ (\rho^m - \rho^{so}) < \zeta\} \Rightarrow (\rho^m - \rho^{so}) < \zeta$; (ii) it reduces both pro-environmental and normative goal preferences if $\{(\rho^m - \rho^{so}) > 0 \ and \ (\rho^m - \rho^{so}) > \zeta\} \Rightarrow (\rho^m - \rho^{so}) > 0$; (iii) it enhances pro-environmental preferences but it reduce normative goal preferences if $\{(\rho^m - \rho^{so}) < 0 \ and \ (\rho^m - \rho^{so}) > \zeta\} \Rightarrow \zeta < (\rho^m - \rho^{so}) < 0$.

*Deriving the values of $(\partial k^*/\partial s_l)$ and $(\partial x_o^*/\partial s_l)$*

Recall that the optimal solution $(k^*, x_o^*)$ satisfies the first-order condition, (9) and (10). A differentiation of (10) with respect to $s_l$ yields:

$$\frac{\partial\left(\frac{b'(k^*)}{w_o'(k^*)}\right)}{\partial k^*}\frac{\partial k^*}{\partial s_l} = x_o^* \frac{\partial\left(\frac{1-\theta}{\theta}\right)}{\partial\theta}\frac{d\theta}{ds_l} + \left(\frac{1-\theta}{\theta}\right)\frac{\partial x_o^*}{\partial k^*}\frac{\partial k^*}{\partial s_l} \Rightarrow$$

$$(A1) \qquad \frac{\partial k^*}{\partial s_l}\left[\frac{\partial\left(\frac{b'(k^*)}{w_o'(k^*)}\right)}{\partial k^*} - \frac{(1-\theta)}{\theta}\frac{\partial x_o^*}{\partial k^*}\right] = -\frac{x_o^*}{\theta^2}\frac{d\theta}{ds_l}$$

Furthermore, by differentiating (9) with respect to $s_l$ we get that;

$$q_o'' \frac{\partial x_o^*}{\partial s_l} = \frac{\partial \left( \frac{w_o(k^*)}{p + s_p} \right)}{\partial k^*} \frac{\partial k^*}{\partial s_l} \Rightarrow \frac{\partial x_o^*}{\partial s_l} = \frac{w_o'}{q_o''(p + s_p)} \frac{\partial k^*}{\partial s_l} \qquad (A2)$$

However, note that:

$$(A3) \qquad q_o'' \frac{\partial x_o^*}{\partial k^*} = \frac{\partial \left( \frac{w_o(k^*)}{p + s_p} \right)}{\partial k^*} \Rightarrow \frac{\partial x_o^*}{\partial k^*} = \frac{w_o'}{q_o''(p + s_p)}$$

Thus, by (A3), (A2) becomes:

$$(A4) \qquad \frac{\partial x_o^*}{\partial s_l} = \frac{\partial x_o^*}{\partial k^*} \frac{\partial k^*}{\partial s_l}$$

*Deriving the values of* $\left(\partial k^*/\partial s_p\right)$ *and* $\left(\partial x_o^*/\partial s_p\right)$

Following a similar procedure as before, a differentiation of Eq(9) with respect to $s_p$ yields:

$$(A5) \qquad \frac{\partial \left( \frac{b'(k^*)}{w_o'(k^*)} \right)}{\partial k^*} \frac{\partial k^*}{\partial s_p} = x_o^* \frac{\partial \left( \frac{1-\theta}{\theta} \right)}{\partial \theta} \frac{d\theta}{ds_p} + \left( \frac{1-\theta}{\theta} \right) \frac{\partial x_o^*}{\partial s_p}$$

whereas a differentiation of (10) with respect to $s_p$ yields:

$$q_o'' \frac{\partial x_o^*}{\partial s_p} = \frac{\partial \left( \frac{w_o(k^*)}{p + s_p} \right)}{\partial s_p} \Rightarrow q_o'' \frac{\partial x_o^*}{\partial s_p} = \frac{w_o' \left( \frac{\partial k^*}{\partial s_p} \right) (p + s_p) - w_o}{(p + s_p)^2} \Rightarrow$$

$$(A6) \qquad \frac{\partial x_o^*}{\partial s_p} = \frac{w_o' \left( \frac{\partial k^*}{\partial s_p} \right)}{q_o''(p + s_p)} - \frac{w_o}{q_o''(p + s_p)^2}$$

By using (9) and (A3), (A6) becomes:

$$(A7) \qquad \frac{\partial x_o^*}{\partial s_p} = \frac{\partial x_o^*}{\partial k^*} \frac{\partial k^*}{\partial s_p} - \frac{q_o'}{q_o''(p + s_p)}$$

Therefore, by substituting (A7) into (A5)

$$\frac{\partial\left(\frac{b'(k^*)}{w_o'(k^*)}\right)}{\partial k^*}\frac{\partial k^*}{\partial s_p} = x_o^*\frac{\partial\left(\frac{1-\theta}{\theta}\right)}{\partial\theta}\frac{d\theta}{ds_p} + \frac{(1-\theta)}{\theta}\left[\frac{\partial x_o^*}{\partial k^*}\frac{\partial k^*}{\partial s_p} - \frac{q_o'}{q_o''(p+s_p)}\right] \Rightarrow$$

$$(A8) \qquad \frac{\partial k^*}{\partial s_p}\left[\frac{\partial\left(\frac{b'(k^*)}{w_o'(k^*)}\right)}{\partial k^*} - \left(\frac{1-\theta}{\theta}\right)\frac{\partial x_o^*}{\partial k^*}\right] = -\left[\frac{1-\theta}{\theta}\frac{q_o'}{q_o''(p+s_p)} + \frac{x_o^*}{\theta^2}\frac{d\theta}{ds_p}\right]$$