Production Incentives from Static Decoupling: Entry, Exit and Use Exclusion Restrictions

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Abstract

The use of agricultural decoupled support has increased as World Trade Organization (WTO) member nations implement less trade distortive policies. However, the true production effects of these policies are still unclear. We show how the exclusion restrictions of U.S. direct payments, namely, the fruit and vegetable restriction and the requirement of keeping land in good agricultural use, cause the decoupled payment to become fully coupled over time as relative profits adjust. Theoretically, decoupled payments can be more trade distorting than an equivalent (same level of taxpayer expenditure) fully coupled subsidy.

Keywords: decoupled payments, infra-marginal support, cross-subsidization

JEL classification: Q15, Q17, Q18

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Since the signing of the World Trade Organization (WTO) Agreement and Uruguay Round Agreement on Agriculture (AOA), there has been an increase in the use of infra-marginal support and other decoupled policies. Many member nations have replaced coupled agricultural support policies, in which farmers receive a per unit subsidy granted to every unit of production, with support policies that are not tied directly to current prices, yields or input use in order to comply with obligations outlined in the AOA. These new decoupled policies are thought to be less production and trade distorting than predecessor programs.

Close examination of OECD data reported in annual monitoring reports (e.g., OECD 2007) shows an increase in infra-marginal agricultural support, such as countercyclical payments, payment limits per farm, payments based on a limited amount of output or inputs (e.g., land or animal numbers), production quotas, and historical entitlements, since the signing of the AOA. During this same time period, total producer support declined. In 1986 support to farmers in OECD countries accounted for 39 percent of the farmers' gross receipts, by 2007 this figure had fallen to just 23 percent (OECD 2008). In contrast, infra-marginal support is becoming increasingly prevalent as member nations attempt to move domestic support from the most trade distorting classification, or the Amber Box, to the Green and Blue Boxes, classification designated for minimally or less trade distortive policies. Infra-marginal support accounted for just 30 percent of total producer support in 1986 and 37 percent of total producer support by 2001 (OECD 2008).

However, recent research has shown that infra-marginal subsidies can distort production. The key factor is cross-subsidization where subsidies on a production base indirectly finance

losses on all over base production sold at world market prices (de Gorter, Just and Kropp 2008). Cross-subsidization occurs when world market prices are below the firm's average cost of production. Moreover, cross-subsidization is driven by declining average costs; as the farm expands its production beyond the base amount, the average unit cost of production declines. This decline of per unit costs combined with the higher prices received on infra-marginal production allows production at the extra-marginal level to become profitable, even though this extra-marginal output is sold below the average cost of producing it. In addition to the trade distortion resulting from extra-marginal production, infra-marginal support leads to exit deterrence since some farms would not produce absent the infra-marginal support. This generates an additional source of production distortion.

Although the WTO legal texts do not address the potential trade distorting effects of infra-marginal policies, Dispute Settlement Bodies (DSB) of two recent WTO cases involving EU sugar and Canadian dairy ruled infra-marginal support programs violated the countries' obligations under the AOA on the grounds of cross-subsidization (WTO 2002, 2004). However, at that time, with the exception of Tangermann (1997), there had been no economic analysis of cross-subsidization in the literature. The DSB were silent about the effects of infra-marginal support on decisions to exit and determined the distortion to be only the extra-marginal output, that is, output beyond the quota.

The de Gorter, Just and Kropp (2008) article presents empirical evidence of the various sources of output distortion with cross-subsidization by evaluating infra-marginal subsidies for U.S. dairy farmers. Results show that output distortions due to infra-marginal subsidies are significant and close to that of a fully coupled subsidy in the short run. Theoretically, it is possible that infra-marginal support is more output distorting than an equivalent fully coupled

subsidy. In addition, they show that production distortions due to exit deterrence are much higher than the extra-marginal output distortion analyzed by the WTO.

The issues of cross-subsidies and exit deterrence center around infra-marginal support where farms receive higher revenue on only a limited amount of output. This is exactly the case for U.S. direct payments notified in the Green Box. In 1996, the United State enacted the Federal Agricultural Improvement and Reform Act of 1996 (FAIR), known as the Agricultural Market Transition Act (AMTA) which introduced Production Flexibility Contracts (PFC). This decoupled direct payment program was designed to replace the old system of coupled prices supports and was to be phased-out prior to the subsequent Farm Bill. The FAIR Act both combated rising costs associated with maintaining existing coupled price support programs and honored commitments outlined in the AOA. Through the PFC program, operators receive payments based on historical base acres and yields regardless of current plantings. Hence, these decoupled payments are not tied to current production, prices or inputs. Yet, operators are required to comply with several regulations to remain eligible for the payments, namely, the land tied to base acres must be kept in good agricultural use and base acres cannot be used in the production of specialty crops such as fruits and vegetables. Emergency legislation in 1998-2001 awarded additional Market Loss Assistance (MLA) payments, a form of counter-cyclical payment, to recipients of PFC payments essentially doubling the support they received. The 2007 Farm Bill not only continued both PFC and MLA payments but also allowed farmland owners to update base acreage and yields upon which their benefits are calculated.

Since farmers in the US are not formally required to obtain these decoupled payments and they do not have to produce to receive the payment, the arguments of cross-subsidization and exit deterrence do not apply in a straightforward manner. Nevertheless, there are features of the

U.S. Green Box subsidies that generate cross-subsidization and exit deterrence effects. One can identify four different mechanisms whereby U.S. decoupled payments distort production that are related to the concepts of cross-subsidization and exit deterrence. These mechanisms are discussed in detail in the next section and center around the exclusion restrictions of U.S. direct payments. We show that the exclusion restrictions combined with other aspects of the program's implementation, such as payments accruing to operators, lead to land use distortions and hence production distortions over time as the demand for land for the excluded uses increases. Therefore, while U.S. direct payments may be "decoupled" in a static analysis, over time, as relative profits adjust, these programs eventually become essentially fully coupled. Currently, the US is experimenting with removing the fruit and vegetable restriction, due in part to the recent WTO case involving U.S. cotton subsidies, but not the non-agricultural uses restriction. The arguments of cross-subsidization still hold even if the planting restrictions are removed as long as the good agricultural use requirement is maintained.

In this paper, we show the mechanisms by which such exclusion restrictions can cause substantial production effects over time. Furthermore, we show that decoupled payments can be more trade distorting than an equivalent fully coupled subsidy. However, we leave the estimation of the production distortions attributed to direct payments to future research.

Decoupled Payments and Production

Early research on decoupled payments and infra-marginal supports concludes when infra-marginal payments do not affect production decisions on the margin, then these payments have no impact on output levels and thus no trade distorting effects (Rucker, Thurman, and Sumner 1995; Rucker and Thurman 1990; Borges and Thurman 1994; Sumner and Wolf; Blandford, de

Gorter and Harvey 1989). However, this early research simply looks at infra-marginal payments in a static framework ignoring the possibility of cross-subsidization. In addition to cross-subsidization, there are several other mechanisms through which payments seemingly not tied to current production can still provide production incentives.

These mechanisms include impacting attitudes toward risk; affecting decisions on leisure and savings; overcoming credit constraints or other input market imperfections; and changing farmer's expectations about future government agricultural support policies. Hennessy (1998) shows that wealth effects generated by decoupled payments impact attitudes toward risk. Hence, decoupled payments can lead to increases in production if the farmer is risk-averse and his preferences can be characterized by a decreasing absolute risk aversion (DARA) utility function. Other research has found a positive relationship between decoupled payments and the number of on-farm work hours thus likely effecting aggregate production (Burfisher and Hopkins 2004). Furthermore, direct payments provide a known stream of cash inflows. These cash inflows serve as a verifiable signal of an improvement of the farmer's liquidity that might lead lenders to perceiving this farmer as more creditworthy (Gonzalez-Vega *et al*. 2006). Therefore, decoupled payments may improve a farmer's access to credit or cost of capital. In addition, uncertainty regarding future government policies is likely to influence current production. Goodwin and Mishra (2006) assume that farmers maximize their expected utility of wealth and show that uncertainty regarding future decoupled payments may affect the optimal allocation of acreage. Bhaskar and Beghin (2007) show that policy uncertainty about the possibility of updating the number of base acres or yield being allowed in the future has a positive effect on the number of acres planted.

Moreover, Chau and de Gorter (2005) demonstrated that while infra-marginal payments do not affect production discussions on the margin, they deter producers from exiting the industry, thereby distorting aggregate output levels. They argue that since infra-marginal payments allow producers to cover fixed costs, this enables some producers to remain in business when they would have exited the industry absent the payment. Building on their work, de Gorter, Just and Kropp (2008) show that it is actually declining average costs that leads to exit deterrence and cross-subsidization. However, the authors assume that farmers must produce in order to receive the infra-marginal payments. Therefore, since farmers in the US are not formally required to obtain direct payments and they do not have to produce to receive the payments, the arguments of cross-subsidization and exit deterrence do not apply to direct payments in a straightforward manner. However, one can identify four different mechanisms whereby U.S. decoupled payments distort production that have not been identified in the literature to date and are all related to the concepts of cross-subsidization and exit deterrence.

First, land has to be kept in "good agricultural use" for farmers to remain eligible to receive direct payments. Therefore, a farmer necessarily incurs fixed costs to comply and so it may be optimal to incur variable costs as well. Thus, the decoupled support causes some farmers to produce when they otherwise would not. If these fixed costs were not incurred, the most profitable option may have been to keep the land idle.

Second, there is the restriction that no land receiving payments can to be used in the production of fruits and vegetables or other specialty crops. Therefore, some land that otherwise would be used for fruit and vegetable production now remains in crop production. The effects of the combined restrictions of keeping land in "good agricultural use" and not in fruit and vegetable production automatically means farmers have to produce to get decoupled payments.

In other words, decoupled payments acts as an infra-marginal subsidy and cross-subsidize crop production that otherwise would have been in excludable acreage like fruits and vegetables, forest, recreational and other uses.

Third, the decoupled payment becomes a coupled distortion if over time the demand for excludable land expands. This can be shown in Figure 1. Assume that total land is fixed and that land is either used in the production of "allowed" crops (includes both base acreage and non-base acreage plantings of allowable crops) or "not allowed" (all other uses of land including plantings of restricted crops and non-agricultural uses). Initially, before any subsidy, there is equilibrium between "allowed" and "not allowed" land uses represented by L* (point *a*). A decoupled subsidy on base acres shifts the demand for land with associated base acres up to D'_A, but because it is decoupled, land use does not change (the price of "allowed" land goes up by the amount of the subsidy). But if over time the demand for "not allowed" land increases (as it has in the US), then the observed amount of land in "allowed" uses (crops complying with plating restriction) may not change but the new demand for "not allowed" land intersects the demand for "allowed" land at a higher point (point *b*) resulting in a higher price for "not allowed" land. Consequently, even though observed land use has not changed, there is an unobserved distortion in land use since absent the decoupled support more land would be in "not allowed" crops such as fruits, vegetables, forests, recreation, or even developed. The unobserved distortion is given by the distance L' to L*.

Fourth, and perhaps most importantly, there are two features of U.S decoupled payments that effectively requires farmers to produce in order to get the payments: 1) base acres and program yields are updated, and 2) farm operators by law receive payments (not the landowner who owns the rights to decoupled payments). The implication of updating is that there is some

positive probability planting additional acres in the current period increases gross receipts in future periods. Hence, farmers are acting as if they have to produce to get the payments. The implication of the requirement that farm operators receive the payments is that if they do not produce, they do not receive any payments. Because recent research has shown that only 20-25 percent of decoupled payments are capitalized into land rental values (Kirwan 2008), it follows that farm operators have every incentive to produce in order to receive the payments. Therefore, both features of updating and farm operators receiving the payments automatically make the entire decoupled payment a bona fide infra-marginal subsidy for the within "allowed" land production decisions.

U.S. decoupled programs therefore cause production distortions due to cross-subsidization and exit deterrence effects. In the next section, we model how exclusion restrictions can cause substantial production effects over time and ultimately cause the decoupled payment to become essentially fully coupled. We also show that in theory these distortions can be greater than the distortions resulting from an equivalent amount of money spent on a fully coupled subsidy. The outcome is an empirical question, depending on the farm size distribution and corresponding cost structures.

A Model of Production Exclusion Restrictions

Suppose a producer has land represented by the interval $\mathbf{L} \equiv \left[\underline{L}, \bar{L} \right] \subset \mathbf{R}$, of varying quality. The producer must decide on how to divide the land between various competing uses based upon the attributes of the land. For simplicity, suppose the attributes of the land can be summarized in a function $F \quad L \quad : \mathbf{L} \to \mathbf{R}$. Thus, the producer must find a partition of land solving

(1) $$\max_{n,\ L_i, s_i\ _{i=1}^{n-1}} \sum_{i=1}^{n} \left\{ \int_{L_{i-1}}^{L_i} \Pi_{x_i} \quad F \quad L \quad dL \right\}$$

subject to

(2) $$L_0 = \underline{L}, L_n = \bar{L},$$

where, n is the chosen number of land plots , and $\Pi_x \equiv p_{x|F} y^*_{x|F} - c_{x|F} \quad y^*_{x|F}$ represents the profit from using a piece of land for activity *x* as a function of the land attributes. Here $p_{x|F}$ is the price per unit of output from activity x given land quality F , $c_{x|F} \quad y$ is the cost for producing y units from activity x given land quality F , and $y^*_{x|F}$ solves the standard first order condition $p_{x|F} - c_{x|F}\ '\ y^*_{x|F} \quad = 0$. Figure 2 represents an example of a choice problem as embodied in (1) and (2) with three possible activities. The optimal partition is determined by the intersections of the profit functions, or more specifically where the two uppermost profit functions intersect.

A fully coupled subsidy could be included in our model by defining an activity specific production subsidy for each activity, s_x . In this case, the profit function for each activity is redefined as $\Pi_x \equiv \quad p_{x|F} + s_x \quad y^*_{x|F} - c_{x|F} \quad y^*_{x|F}$, thus leading to an increase in $y^*_{x|F}$ (the intensive margin) and an increase in land devoted to activities with production subsidies (the extensive margin). For any specific piece of land, totally differentiating the first order condition with respect to the subsidy and production yields $dy^*_{x|F} \big/ ds_x = 1 \big/ c_{x|F}\ "\ y^*_{x|F}$, which is positive under the standard assumption of a convex cost function. Define $\mu_{x|F} \equiv p_{x|F} - c_{x|F} \quad y^*_{x|F}$ as the market rent. The extent of land use is determined by the points of indifference

(3) $$s_{x_i} y^*_{x_i|F\ L_i} + \mu_{x_i|F\ L_i} \quad y^*_{x_i|F\ L_i} = s_{x_j} y^*_{x_j|F\ L_i} + \mu_{x_j|F\ L_i} \quad y^*_{x_j|F\ L_i} \quad .$$

Totally differentiating (3) with respect to the subsidy on activity *i* and the location of the switch point L_i yields

(4)

$$\frac{dL_i}{ds_{x_i}} = -\frac{\left\{ y^*_{x_i|F\ L_i} + \left[s_{x_i} + \mu_{x_i|F\ L_i}\ '\ y^*_{x_i|F\ L_i} \right] \frac{dy^*_{x_i|F\ L_i}}{ds_{x_i}} \right\}}{\left\{ \frac{d\,\mu_{x_i|F\ L_i}\ \ y^*_{x_i|F\ L_i}}{dF\ \ L_i} + \left[s_{x_i} + \mu_{x_i|F\ L_i}\ '\ y^*_{x_i|F\ L_i} \right] \frac{dy^*_{x_i|F\ L_i}}{dF\ \ L_i} - \frac{\partial \mu_{x_j|F\ L_i}\ \ y^*_{x_j|F\ L_i}}{\partial F\ \ L_i} - \left[s_{x_j} + \mu_{x_j|F\ L_i}\ '\ y^*_{x_j|F\ L_i} \right] \frac{dy^*_{x_j|F\ L_i}}{dF\ \ L_i} \right\} F'\ L_i}$$

.

Here we must first note that $s_{x_1} + \mu_{x_i|F\ L_i}\ '\ y^*_{x_i|F\ L_i} = 0$ by first order conditions. Thus, we can rewrite (4) as

(5)

$$\frac{dL_i}{ds_{x_i}} = -\frac{y^*_{x_i|F\ L_i}}{\left\{ \frac{d\,\mu_{x_i|F\ L_i}\ \ y^*_{x_i|F\ L_i}}{dF\ \ L_i} - \frac{\partial \mu_{x_j|F\ L_i}\ \ y^*_{x_j|F\ L_i}}{\partial F\ \ L_i} \right\} F'\ L_i},$$

If L_i is an upper bound on activity i, then the denominator will necessarily be positive, increasing the extensive margin. To see this, note that the condition for an upper bound (derived by taking the derivative of (3)) is

(6)

$$\left[s_{x_i} \frac{dy^*_{x_i|F\ L_i}}{dF\ \ L_i} + \frac{d\,\mu_{x_i|F\ L_i}\ \ y^*_{x_i|F\ L_i}}{dF\ \ L_i} + \mu_{x_i|F\ L_i}\ '\ y^*_{x_i|F\ L_i}\ \ \frac{dy^*_{x_i|F\ L_i}}{dF\ \ L_i} \right] F'\ L_i < \left[s_{x_j} \frac{dy^*_{x_j|F\ L_i}}{dF\ \ L_i} + \frac{d\,\mu_{x_j|F\ L_i}\ \ y^*_{x_j|F\ L_i}}{dF\ \ L_i} + \mu_{x_j|F\ L_i}\ '\ y^*_{x_j|F\ L_i}\ \ \frac{dy^*_{x_i|F\ L_i}}{dF\ \ L_i} \right] F'\ L_i$$

.

Alternatively, if L_i represents a lower bound on the activity, then the sign of (5) will be negative.

Finally, $\frac{dy^*_{x|F}}{dF} = -\frac{\partial \mu_{x|F}\ '\ y^*_{x|F}}{\partial F} \Big/ \mu_{x|F}\ "\ y^*_{x|F}$, which will be positive if profit for activity x increases with F and negative otherwise.

Alternatively, suppose the producer faces a decoupled payment system, so that he receives a payment equal to D on all base land upon which he does not engage in excluded uses. For simplicity, we suppose that all acres under consideration are allocated to base acreage. The policy was created so that all base acres were engaged in allowable uses at the time base acreage was set. Thus the producer problem can be written as

(7) $$\max_{n,\ L_i, s_i\ _{i=1}^{n-1}} \sum_{i=1}^{n} \left\{ \int_{L_{i-1}}^{L_i} \Pi_{x_i}\ \ F\ \ L\ \ + D_i\ \ dL \right\}$$

subject to

(8) $$L_0 = \underline{L}, L_n = \bar{L},$$

and where

$$D_i = \begin{cases} D & \text{if} \quad i \in \mathbf{A} \\ 0 & \text{if} \quad i \notin \mathbf{A} \end{cases}$$

where $\mathbf{A}$ is the set of allowable land uses and D is the decoupled payment. Figure 3 displays the profit function for land at the time base acreage is set, supposing only two possible activities. At this time, all acres are used in activity 1 due to its dominant profit over activity 2. The decoupled payment increases the per acre profit by *D* causing the profit function to shift up for all land attribute values. Because the subsidy is not tied to production, it will not affect the first order conditions for production decisions on any base acre. Further, because all base acres are initially more profitable in the allowed activities than not allowed, the decoupled payment should not induce changes on the extensive margin.

However, once base acres are determined, the relative profits from allowable and unallowable uses may change. Figure 4 depicts the same base acres after a shift in the value of the excluded and included uses (e.g., urban development versus corn production). If the value of allowable uses declines and/or the value of unallowable uses increases, then the decoupled payments begin to substantially influence production choices. For example in Figure 4, under the decoupled payment, all land to the left of L'_1 will be devoted to the excluded use, while all land to the right will be devoted to the allowable use. Without the decoupled payment, this point would shift up discretely to L_1, placing much more land in the excluded use. This is a particularly important point given the changing values of land in traditional crops versus fruit and vegetables which have been excluded from decoupled payments. Under this scenario the decoupled payment will still not impact decisions regarding the intensive margin of production, but could substantially impact the extensive margin.

The new switch point can be captured by rewriting (3) as

$$\mu_{x_i|F\ L_i}\quad y^*_{x_i|F\ L_i}\quad + D_i = \mu_{x_j|F\ L_i}\quad y^*_{x_j|F\ L_i}\quad + D_j\,. \tag{9}$$

We can now totally differentiate (9) to determine the impact of the decoupled payment on the extensive margin supposing activity j is an excluded use. This yields

$$\frac{dL_i}{dD_i} = -\frac{1}{\left[\dfrac{\partial \mu_{x_i|F\ L_i}\quad y^*_{x_i|F\ L_i}}{\partial F\quad L_i} - \dfrac{\partial \mu_{x_j|F\ L_i}\quad y^*_{x_j|F\ L_i}}{\partial F\quad L_i}\right] F'\ L_i}\,. \tag{10}$$

As with (5), the denominator will be positive if L_i is an upper bound, and negative otherwise. Thus, decoupled payments affect land use and lead to production distortions over time.

Taxpayer Costs for Equivalent Direct and Decoupled Subsidies

Decoupled payments were introduced primarily as a way to provide subsidies without distorting trade through increased production. While it is useful to note that decoupled payments can create incentives for increased production as markets shift, it is important to determine the size and costs of these effects. Thus, the purpose of this section is to determine the size of a decoupled payment that would be required to increase production to the equivalent of a given direct production subsidy and to compare the costs of such programs.

To begin our analysis, we define a coupled and decoupled subsidy to be equivalent if they result in the same level of total production. In this sense both would distort trade equally. Thus, the subsidy and decoupled payment satisfies

$$\sum_{i:x_i=x} \int_{L_{i-1}}^{L_i} \int_{D_i}^{D_i} y^*_{x_i|F\ L}\ \ 0\ \ dL = \sum_{i:x_i=x} \int_{L_{i-1}}^{L_i} \int_{s_i}^{s_i} y^*_{x_i|F\ L}\ \ s_i\ \ dL$$

Totally differentiating obtains

$$\frac{dD_i}{ds_i} = \frac{\sum_{i:x_i=x} \left[y^*_{x_i|F\ L_i}\ \ s_i\ \ \frac{dL_i\ \ s_i}{ds_i} - y^*_{x_i|F\ L_{i-1}}\ \ s_i\ \ \frac{dL_{i-1}\ \ s_i}{ds_i} + \int_{L_{i-1}\ s_i}^{L_i\ s_i} \frac{dy^*_{x_i|F\ L_i}\ \ s_i}{ds_i} dL \right]}{\sum_{i:x_i=x} \left[y^*_{x_i|F\ L_i}\ \ 0\ \ \frac{dL_i\ \ D_i}{dD_i} - y^*_{x_i|F\ L_{i-1}}\ \ 0\ \ \frac{dL_{i-1}\ \ D_i}{dD_i} \right]}$$

or, if we evaluate from a starting point of no subsidy

(11)

$$\left.\frac{dD_i}{ds_i}\right|_{\substack{D_i=0\\ s_i=0}} = \frac{\sum_{i:x_i=x}\left[-\frac{y^{*2}_{x_i|F\ L_i}}{\left\{\frac{d\mu_{x_i|F\ L_i}\ y^*_{x_i|F\ L_i}}{dF\ L_i}-\frac{\partial\mu_{x_j|F\ L_i}\ y^*_{x_j|F\ L_i}}{\partial F\ L_i}\right\}F'\ L_i}+\frac{y^{*2}_{x_i|F\ L_{i-1}}}{\left\{\frac{d\mu_{x_i|F\ L_{i-1}}\ y^*_{x_i|F\ L_{i-1}}}{dF\ L_i}-\frac{\partial\mu_{x_j|F\ L_{i-1}}\ y^*_{x_k|F\ L_{i-1}}}{\partial F\ L_i}\right\}F'\ L_{i-1}}+\int_{L_{i-1}\ s_i}^{L_i\ s_i}1/\mu_{x_i|F\ L_{i-1}}{}''\ y^*_{x_i|F\ L_{i-1}}\ dL\right]}{\sum_{i:x_i=x}\left[-\frac{y^*_{x_i|F(L_i)}}{\left[\frac{\partial\mu_{x_i|F(L_i)}(y^*_{x_i|F(L_i)})}{\partial F(L_i)}-\frac{\partial\mu_{x_j|F(L_i)}(y^*_{x_j|F(L_i)})}{\partial F(L_i)}\right]F'(L_i)}+\frac{y^*_{x_i|F(L_{i-1})}}{\left[\frac{\partial\mu_{x_i|F(L_{i-1})}(y^*_{x_i|F(L_{i-1})})}{\partial F(L_i)}-\frac{\partial\mu_{x_k|F(L_{i-1})}(y^*_{x_j|F(L_{i-1})})}{\partial F(L_i)}\right]F'(L_{i-1})}\right]}$$

All values in both the denominator and numerator are positive, as shown earlier. If the impact of expenditure on production is equal for the two policies, then $dD_i/ds_i = \bar{y}$, where

$$\bar{y} = \frac{\sum_{i:x_i=x}\int_{L_{i-1}\ s_i}^{L_i\ s_i} y^*_{x_i|F\ L}\ \ s_i\ dL}{\sum_{i:x_i=x} L_i\ \ D_i\ - L_{i-1}\ \ D_i},$$

or the average level of production for the target good.

The derivative in (11) can be less than $\bar{y}$ implying that for the same level of expenditure, the decoupled payment is *more* trade distorting. The simplest example can be found in the case where the producer faces constant returns to scale in all non-land inputs, so that $\mu'' = 0$. Suppose further that all land devoted to the admissible activity is contiguous (i.e., all profits for all activities display the single crossing property in L), so that (11) can be rewritten as

$$\left.\frac{dD_i}{ds_i}\right|_{\substack{D_i=0\\ s_i=0}} = \frac{\left[-\frac{y^{*2}_{x_i|F\ L_i}}{\left\{\frac{d\mu_{x_i|F\ L_i}\ y^*_{x_i|F\ L_i}}{dF\ L_i}-\frac{\partial\mu_{x_j|F\ L_i}\ y^*_{x_j|F\ L_i}}{\partial F\ L_i}\right\}F'\ L_i}+\frac{y^{*2}_{x_i|F\ L_{i-1}}}{\left\{\frac{d\mu_{x_i|F\ L_{i-1}}\ y^*_{x_i|F\ L_{i-1}}}{dF\ L_i}-\frac{\partial\mu_{x_j|F\ L_{i-1}}\ y^*_{x_k|F\ L_{i-1}}}{\partial F\ L_i}\right\}F'\ L_{i-1}}\right]}{\left[-\frac{y^*_{x_i|F\ L_i}}{\left[\frac{\partial\mu_{x_i|F\ L_i}\ y^*_{x_i|F\ L_i}}{\partial F\ L_i}-\frac{\partial\mu_{x_j|F(L_i)}(y^*_{x_j|F(L_i)})}{\partial F\ L_i}\right]F'(L_i)}+\frac{y^*_{x_i|F(L_{i-1})}}{\left[\frac{\partial\mu_{x_i|F(L_{i-1})}(y^*_{x_i|F(L_{i-1})})}{\partial F\ L_i}-\frac{\partial\mu_{x_k|F(L_{i-1})}(y^*_{x_j|F(L_{i-1})})}{\partial F\ L_i}\right]F'(L_{i-1})}\right]}$$

By the intermediate value theorem, this can be rewritten as

$$\frac{dD_i}{ds_i} = \tilde{y}\frac{\left[-\frac{y^*_{x_i|F\ L_i}}{\left\{\frac{d\mu_{x_i|F\ L_i}\ y^*_{x_i|F\ L_i}}{dF\ L_i} - \frac{\partial\mu_{x_j|F\ L_i}\ y^*_{x_j|F\ L_i}}{\partial F\ L_i}\right\}F'\ L_i} + \frac{y^*_{x_i|F\ L_{i-1}}}{\left\{\frac{d\mu_{x_i|F\ L_{i-1}}\ y^*_{x_i|F\ L_{i-1}}}{dF\ L_i} - \frac{\partial\mu_{x_j|F\ L_{i-1}}\ y^*_{x_k|F\ L_{i-1}}}{\partial F\ L_i}\right\}F'\ L_{i-1}}\right]}{\left[-\frac{y^*_{x_i|F\ L_i}}{\left[\frac{\partial\mu_{x_i|F\ L_i}\ y^*_{x_i|F\ L_i}}{\partial F\ L_i} - \frac{\partial\mu_{x_j|F\ L_i}\left(y^*_{x_j|F\ L_i}\right)}{\partial F\left(L_i\right)}\right]F'\left(L_i\right)} + \frac{y^*_{x_i|F\left(L_{i-1}\right)}}{\left[\frac{\partial\mu_{x_i|F\left(L_{i-1}\right)}\left(y^*_{x_i|F\left(L_{i-1}\right)}\right)}{\partial F\left(L_i\right)} - \frac{\partial\mu_{x_k|F\left(L_{i-1}\right)}\left(y^*_{x_j|F\left(L_{i-1}\right)}\right)}{\partial F\left(L_i\right)}\right]F'\left(L_{i-1}\right)}\right]} = \tilde{y}$$

where $\tilde{y} \in \left[y^*_{x_i|F\ L_i}, y^*_{x_i|F\ L_{i-1}}\right]$, or within the interval formed by the level of production on the marginal boundaries of production. Clearly, in most reasonable cases, the production level at the boundaries will be substantially lower than the average production level. Thus in this case, a given level of expenditures on a decoupled subsidy can increase production by more than the same level of expenditure when using a direct production subsidy. The intuition is that marginal lands will receive a lower subsidy when the payments are tied directly to production. This is because these lands provide poor conditions for production and thus cannot easily capture the production subsidy. Alternatively, the decoupled payment provides a very large incentive on a production basis for the marginal lands. Of course, most decoupled payment policies base payments on historical production levels.

However, the ability to potentially update base acreage or yields provides an incentive to increase current plantings on marginal land. If producers face some positive probability that updating will occur, then this may cause the expected present value of planting marginal land in the current period to become positive due to the value associated with the possible future stream of direct payments. By planting the marginal land in the current period the operator has the ability to increase base acreage should updating become an available option.

Since direct payments were introduced in the FAIR Act in 1996, farmers have had the opportunity to update both the number of base acres and yields associated with existing base acres. The 2002 Farm Bill allowed farmland owners to update program base acres and payment yields used to calculate program benefits such as direct and counter-cyclical payments. While the 2007 Farm Bill does not allow updating, it introduced a new option in which enrolled operators' benefits are based on moving averages linked to both market prices and yields thus essentially inducing the same response from operators as uncertainty regarding updating.

Conclusions

The use of agricultural infra-marginal support and decoupled payments has been on the rise since the inception of the WTO and the signing of the Agreement on Agriculture. However, the effects of these policies on production are still unclear. Many studies have found varying degrees of distortion associated with decoupled payments and present a host of mechanism by which decoupled payments influence current production including effects on risk attitudes, impacts on access to credit and overcoming other imperfect input markets, changing expectations regarding future government support policies, and influencing the decision to exit.

Our analysis contributes to the emerging literature on the production effects of decoupled programs. In this paper, we show how exclusion restrictions cause direct payments to become infra-marginal and hence arguments of cross-subsidization and exit deterrence are applicable. Specifically, we show that the fruit and vegetable restriction and the requirement that land must be kept in good agricultural use, combined with other aspects of how direct payments are administered such as payments accruing to operators and the possibility of updating, in essence causes the operator to act as if he must produce to receive the payment. In addition, we show that

over time, as relative profits adjust, the restrictions cause the decoupled payment to become fully coupled. Therefore, while direct payments may be decoupled in a static analysis, they are become coupled over time.

In addition, we find that the effects of direct payments on production can be substantial. Theoretically, it is possible for a decoupled direct payment to be more distortive than a fully coupled policy resulting from the same level of taxpayer expenditure. Ultimately, which policy option leads to a higher output distortion is an empirical question, depending on the farm size distribution and corresponding cost structures. We leave the estimation of output distortions associated with U.S. direct payments to future research.

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Figure 1. Effect of Land Use Restrictions with Decoupled Payments as Demand for "Not Allowed" Land Expands

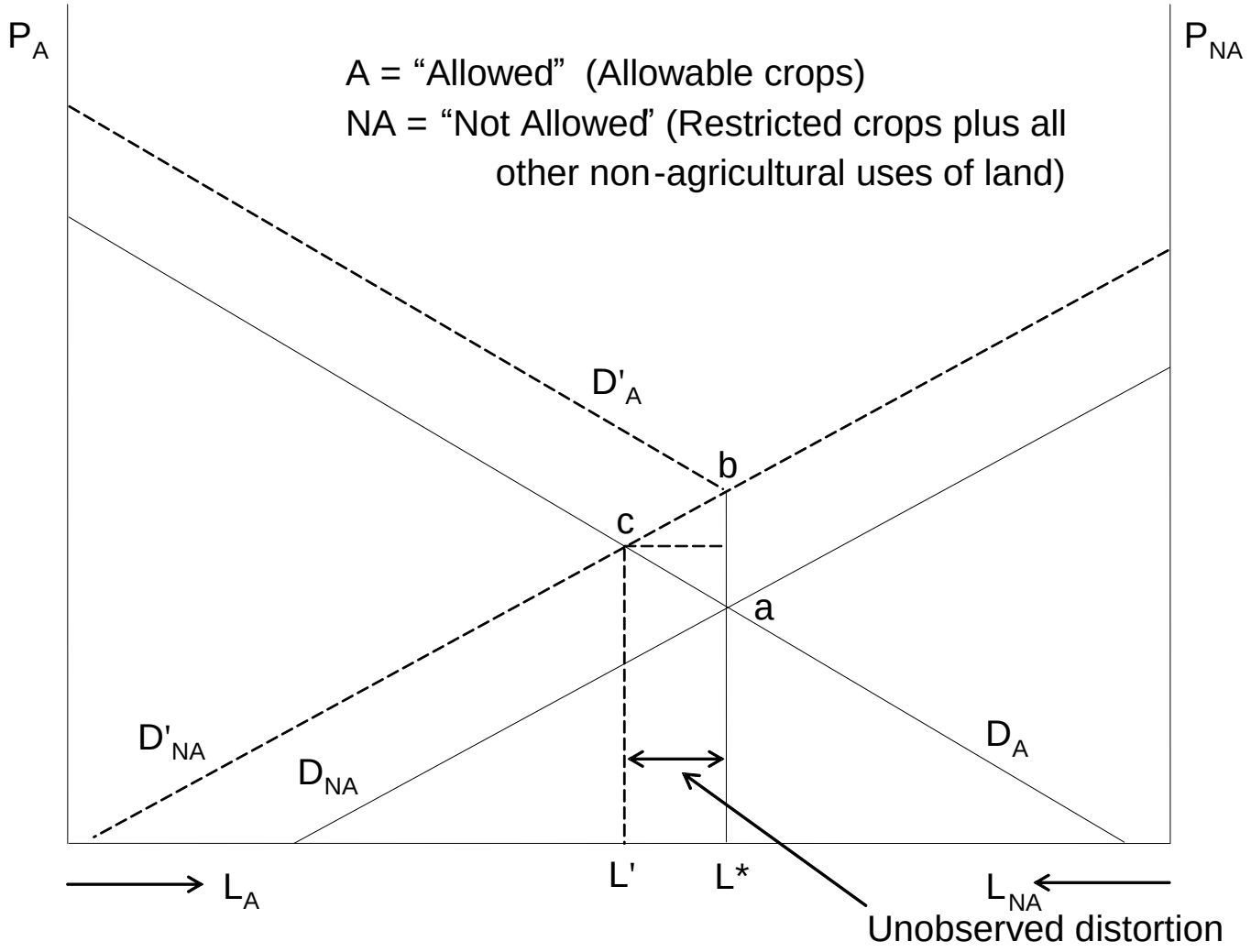

Figure 2. The Land Allocation Problem

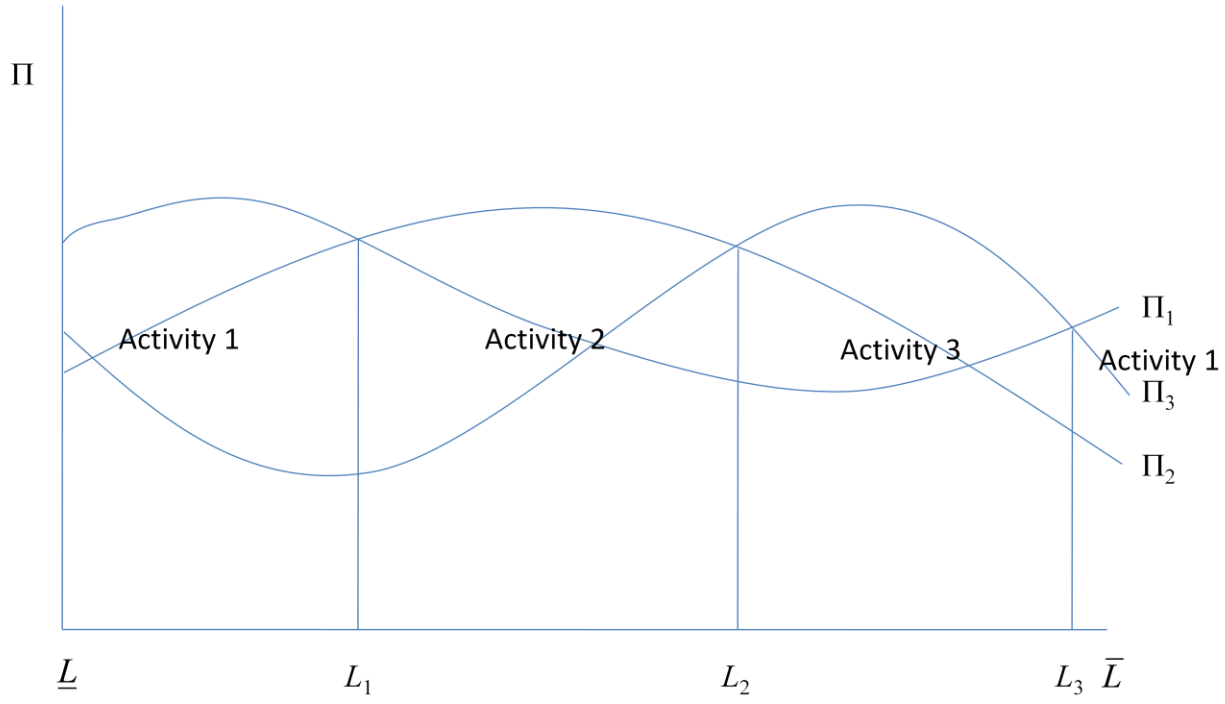

Figure 3. Decoupled Payments at Base

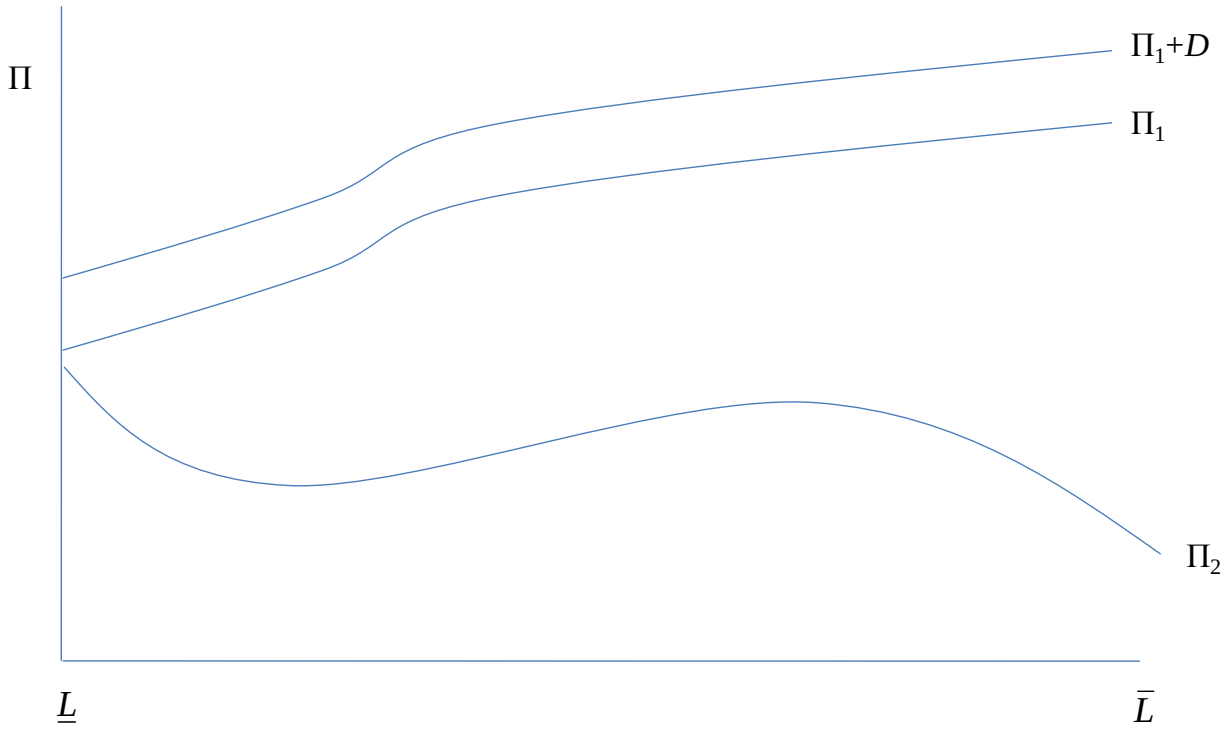

Figure 4. Decoupled Payments after Base