Modeling Production Response to "More Decoupled" Payments

by

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Abstract

Several significant changes in agricultural policy in OECD countries over the last two decades have been driven by the concept of “decoupling”. In practice, these “more decoupled” payments have changed from linking support to the output to linking the payments to land, and they have been implemented with increasing freedom to produce. This paper explores the economics that explains why these movements are likely to reduce production effects. However, a broad perspective of all the economic mechanisms that affect farmers´ decision making does not allow for the conclusion that there are no impacts. The magnitude of the impacts of “more decoupled” payments is an empirical question that needs to be investigated using econometric estimation methods. Although the small amount of empirical literature available in this area shows, in general, some impacts, is not conclusive as to their magnitude. This reduces the confidence in simulation results that involve this type of payments. Relevant technical difficulties may explain, but not justify, this lag on the empirical work dealing with the main policy change that has recently occurred in OECD countries. Recent studies using micro data are promising and should be enhanced, while further work is needed to improve the comparability and applicability of estimation results in simulation models.

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Modeling Production Response to "More Decoupled" Payments

Over the last two decades there has been a number of reforms in agricultural policies in certain OECD countries and sectors. The US 1996 FAIR Act created the Production Flexibility Contract (PFC) payments that were followed by the 2002 Direct Payments under the 2002 Farm Bill. In the European Union, the 1992 reform was a first step followed by the 2003 Common Agricultural Policy (CAP) reform that created the Single Farm Payment (SFP). These reforms have been guided by the concept of decoupling domestic support measures from production decisions. Governments and trade negotiators demand estimates and quantifications of the impacts of these reforms and measures. The estimated impacts using different models depend on the features and assumptions of the modeling tool and the policy representation in this modeling framework. It is clear that the representation and assumptions attached to both the original policies and the new policies after reform substantially affect the quantitative results (Gohin).

This paper investigates the modeling challenges posed by some of the policy measures implemented under these reform processes. The focus is on modeling the payments with the purpose of estimating their impact on production decisions and trade. It is not obvious which instruments should be considered under the heading of "more decoupled" payments. Much of the confusion in the debate on modeling and quantifying "decoupling" is due to the fact that the set of payments that are called "decoupled" or "more decoupled" is not well defined. We apply a pragmatic approach by considering under "more decoupled" payments the main instruments that have been used in this process of reform, out from price / output support and border measures. The discussion of the 2003 CAP Reform has created additional confusion in the terminology and in the technical debate: in this European context, the term "degree of decoupling" is applied to the % of eligible CAP payments that are moved to the new single farm payment. This definition can only be applied to the specific EU policy reform framework and it differs from the empirical definition of the degree of decoupling as the relative production and trade impacts of a given payment as compared to price support (Cahill, OECD). This latter empirical approach is followed in this paper, which implies that the SFP, just as any other program, has a degree of decoupling that needs empirical investigation.

The discussion is organized in three sections. The first section analyses the economics behind the production response to "more decoupled" payments and identifies the mechanisms of response through which this support measures can affect production decisions. The second section identifies the main modeling challenges associated with the main policy developments towards decoupling; that is, linking payments to land (instead of output), and broadening the commodities and activities that can benefit from the payments. The third section briefly assesses how some relevant models represent these policies. The conclusions identify areas where more empirical research is needed.

The economics of production response to "more decoupled" payments

The different production response to payments can be due to two interrelated causes. First, different programs can generate a different set of incentives to producers. These incentives are determined by the characteristics and implementation criteria that define a specific program. Second, the structural features of the farming sector in a given country or region where the instrument is applied affect the capacity and willingness to adjust for a given set of new incentives.

The characteristics of the payments

Table 1 summarizes some basic implementation criteria that are relevant in determining the type of incentives created by a payment scheme. They have been arbitrarily classified under four criteria: a) the nature of the "variable" that determines the amount of the payment received; b) the mathematical relationship between variable a) and the amount of the payment; c) the limits or conditions imposed that constrain the direct application of a) and b); and, finally, d) the commodities and activities that are covered by variable a).

Payments provided proportionally to the output quantities are normally considered as fully coupled payments. But payments can be provided on the basis of the area used for a given activity on the basis of other non land inputs, or even on the basis of the use of risk reducing strategies such as insurance or price hedging. The incentive created in each case can differ significantly. Payments based on output (and also market price support) create incentives to use all the production inputs in order to maximize profits from higher producer net output prices. Payments based on area create incentives to use more land on production instead of other inputs and, therefore, to reduce yields. The same type of reasoning can be applied to any possible variable determining the amount of the payment.

Table 1. Some relevant implementation criteria

Implementation criteria	Some possible options
a) The amount of and the right for the payment depends on:	1. Output quantity 2. Output price 3. Area 4. Non-land inputs 5. Risk-reducing input (insurance, hedging…)
b) The payments are provided:	1. Proportional to a) 2. Positively related to A but not proportional 3. Negatively related to a)
c) There are limits or conditions attached To the payments:	1. Quantitative limits on a) and / or b) 2. Cross compliance conditions on technologies and practices
d) Commodity coverage of the payments	1. Single commodity 2. Several commodities with • Same rate • Different rate 3. Allowing idling (no production required) 4. Excluding some commodities 5. Maintaining land in agricultural use

Once the variable defining the amount of the payment is found, the relationship between the amount of the payment and variable a) needs to be identified. This relationship is often proportional: the payment is defined as a given amount of dollars per ton or per hectare, but it is sometimes the case that this relationship is not proportional. It could be digressive or progressive and create in both cases different types of incentives. It could also be negative or countercyclical. For instance, US countercyclical payments depend negatively on prices. There is also emergency aid in many countries that is provided as a compensation for a production loss: the lower the production, the higher the payment. This type of countercyclical payment typically generates risk related incentives on production that are called insurance effects (Hennessy).

Payments are often subject to different types of constraints that can affect the type and magnitude of the incentives they create whenever the constraints are binding for some farmers. These constraints could limit the eligible quantity of variable a); for instance, the set aside conditions and the maximum eligible area in the area payments in the European Union. They can also truncate, displace or curve the set of incentives created by the payments (OECD, 2002). It is often the case that the effects of those limits are asymmetric: the magnitude of the impacts of the constraint is different for increasing payments as compared to decreasing payments. Additionally, many payments have different types of conditions attached to them, sometimes called cross compliance conditions which are related to agricultural practices and technologies. These conditions impose technological constraints that influence the type and magnitude of farmers' response.

The set of commodities that are supported by a given program or set of programs determines the relative incentives among different activities that typically compete for the use of some scarce resources. A support program that covers a single agricultural production will generate a reallocation of resources that otherwise would be used in other activities in the agricultural sector or in other sectors. On the contrary, a program that covers all agricultural activities will allocate to the agricultural sector resources that otherwise would be used in other sectors. It has been argued that not requiring production, that is that the payment covers the possibility of idling, eliminates the production effects of payments. This is obviously erroneous since idling is an additional activity that is allowed, but there may be other activities that are not eligible for the payment (OECD, 2005). Several "more decoupled" programs cover the possibility of not producing, but requiring maintaining land in agricultural use defined as doing some minimum maintenance agricultural activities. This can be a different activity with different cost incentives than just "idling".

Structural response from producers

Given the set of incentives created by the implementation criteria in Table 1, the response of farmers to these incentives can vary for very different reasons. I will mention some of these without any ambition of being exhaustive:

I. The technology available and the possibilities of adjusting this technology. The use of capital and labor and, particularly, the possibilities of technological substitution between these, other inputs and land are crucial determinants of production response.

II. The relative availability of different resources or inputs. This includes the prices and the mobility of resources, particularly land, but also of other inputs. Legal, physical and other constraints can affect the adjustability of these resources.

III. Whenever some of the input markets are not perfectly competitive or they are incomplete, be it the land market, the labor market, the capital markets or the risk related markets, the preferences of the farmer can influence his business decisions. These preferences include, for instance, labor / leisure and risk preferences. This is likely to be the case for non-commercial farmers.

IV. The expectations created by the implementation criteria of the payment, the government decision making process, or any other source of information. Farmers´ expectations, that are not necessarily an immediate consequence of any objective information, can influence the incentives to adjust or respond to the economic incentives.

The combination of these elements is often correlated with the structural characteristics of the farms in a given country or region, the degree of economic development, the development of markets and legal frameworks, the availability of infrastructures and services, the geography, the climate and the agronomic conditions. All these circumstances are often summarized empirically into a matrix of elasticities of output supply. This matrix is a very useful tool to determine response to support that is provided to the outputs through payments or prices, but it provides insufficient information to determine response to the “more decoupled” payments.

What is decoupling and how can "more decoupled" payments be modeled?

A pragmatic and applied use of the concept of "decoupling" identifies this process with the type of agricultural policy reform that has been experienced in some OECD countries and sectors over the last two decades. For example, the main policy changes occurred in the arable crops sector in the United States and the European Union. The main characteristic of these "decoupling" reforms is the movement away from output related payments or support, mainly market price support. The "decoupling" reforms have substituted this support by "more decoupled" payments. Where are the "decoupling" reforms moving the support to? The principal idea is to provide support to farmers while reducing its incidence on farmers' resource allocation decisions and, therefore, on production and trade. Historically, two main axes have been used for decoupling:

1. From support that depends on the quantity produced to payments based on land.
2. From support defined for individual commodities to payments with more freedom on what to produce.

All current payments that are normally called "more decoupled" are paid on a per hectare basis and, therefore, are based on area. Eligibility for some of these payments is based on historical parameters, but all available examples impose some current conditions on some current land. Why should the movement from output support to land support reduce the production response? Let us assume first that land is a perfect complementary input with respect to the rest of the inputs. This is a Leontief technology between area and the other inputs. If this was the case, it is not important whether a subsidy is given to land or to other inputs: in both cases production will increase in the same way because inputs have to be used in fixed proportions. If there are no economies of scale[2], output support will also have the same impact on production as support to any input.

We need to assume some degree of substitution between area and other inputs (that for simplification we will call "yields") in order to obtain a differentiated output response when supporting

2. This is a common assumption when considering response for a whole country or region where the production technology can be replicated when output expands.

each type of input. In this case, there is an incentive to use more of the subsidized input as compared to the unsubsidized one. For an area payment, more land is brought into production at the expense of other inputs (yields). When moving from price support to area payments one could expect an increase in the use of land and a reduction in yields. A reduction in production will be observed whenever the reduction in yields is larger than the increase in area. This should be the case if the supply of land is inelastic relative to the supply of other inputs. The larger the substitution possibilities and the larger the differences in the elasticity of supply of land as compared to other inputs, the larger the potential for a lower supply response to area payments. But theory does not solve the question of the relative magnitude of production response to payments based on output, area or other inputs.

This is very much related to the degree of capitalization of the area payments on land values and rents. If land supply was fully inelastic, the payment would be fully capitalized on the price of land, and the owner of the land would fully benefit from the payment with no consequence on production. But normally land supply would respond to land payments, and the additional land brought into production would displace the use of other inputs, generating a fall in yields. In this more general case, farmers who do not own the land would also benefit from the area payment and there would be some production response. The magnitude of this response is an empirical question. There are some empirical studies trying to estimate the impact of "more decoupled" payments on land prices in the United States (for instance Roberts, Kirwan and Hopkins), even if there are important technical difficulties in this estimation (Goodwin, Mishra and Ortalo-Magné). This evidence shows partial capitalization of payments such as PFC payments.

The second axis for decoupling has been to broaden the area based payments to a larger set of agricultural activities that are allowed in the benefiting area. In the European context, these two axes have been applied in successive steps: the 1992 CAP reform created commodity specific area payments; the 2003 reform have broadened the eligible activities under the new SFP. What are the economic reasons that underpin the idea that broadening the activities would reduce the production response? The explanation is straight forward: if the farmer has the freedom to decide what to produce (or not to produce) on the land benefiting from the payments, the probability of the payment affecting land allocation decisions is reduced. In other words, the total supply of land for a large set of agricultural activities is expected to be less elastic to payments and rent prices because there are fewer alternative activities to which land could be devoted. However, it is always the case in all known "more decoupled" payments that some agricultural activities are excluded from the land benefiting from the payment[3].

In the context of these two axes, if a "more decoupled" payment is in fact more decoupled, this must be due to one or both of these reasons. The first reason is that the "more decoupled" payments are based on area and producers substitute land for other inputs in production, which generates an important reduction in yields. The second reason is that "more decoupled" payments are provided for a larger set of agricultural activities and, therefore, there is less scope for bringing land from other uses into production.

The main modeling challenges created by the "more decoupled" payments are precisely related to the capacity of models to represent the nuances of these two axes. The first axis demands for a good representation of the technical substitution between land and other inputs. A theoretically consistent model requires both land and yields response to the payments and, very likely, in opposing directions. A proper production function with some degree of technical substitution would capture these effects through a demand for land that can be differentiated from land supply. Several technical possibilities are easily available for this construction. The second axis requires an exhaustive representation of different land uses or, at least, a good estimate of the land supply for the set of activities allowed under the payment. Again there are several technical possibilities to represent this type of land supply system, such as a Constant Elasticity of Transformation (CET) functional form.

There are other relevant modeling issues raised in the literature. For instance, the risk effects of some payments and the income effects of payments in the farm household decision making. Both fall under bullet III on the structural response analyzed in the previous section and they are not specific to "more

3. In the case of US Direct payments, fruits and vegetables are excluded. In the EU, Single Farm Payment, fruits and vegetables and potatoes are excluded in most of the countries. In both cases, land must be maintained in good agricultural use, even if practical terms this later condition is more demanding in the European Union than in the United States.

decoupled" measures. Risk effects can be significant when payments are provided counter-cyclically. Despite the fact that both US Direct Payments and Countercyclical Payments are provided on the same basis (per hectare of historical land with some current conditions), counter-cyclical payments generate additional commodity specific risk-related incentives to produce. The magnitude of these incentives is normally smaller than those created by deficiency payments and its modeling poses challenging questions (Antón and LeMouel). Modelers should not underestimate possible risk-related effects of programs that are not designed as counter-cyclical, but whose provision of resources (the level of the payment) is determined on an *ad hoc* counter-cyclical basis. There is evidence of *ad hoc* counter-cyclicality in aggregate support measures of several OECD countries (OECD, 2004). In this area, the empirical evidence on the degree of farmers´ risk aversion is scarce and not unanimous.

Farm households make decisions — such as on work and leisure, and on savings, investment and consumption — that are conditioned by their levels of income, and all types of payments will have an effect on these decisions. To the extent that "more decoupled" payments are more efficient in transferring income to the farm household (Dewbre, Antón and Thompson), they have the potential for a larger response. The impact on agricultural production is likely to be small in magnitude and unclear in terms of its direction (USDA, OECD 2005b)). The investigation of these effects would better be undertaken using individual data on farm households. This line of research could clarify issues on farm structures and adjustment that have great policy relevance; they are not, however, the focus of this paper.

Finally, there are some modeling questions that are particularly difficult to analyse (OECD, 2005). First, the existence of complex sets of cross compliance conditions covering issues such as animal welfare and environmental standards. Second, the existence of expectations about future policies in a context of reforms that do not change dramatically the level of support but which may cover for cyclical decreases in revenues and may allow for the updating of historical variables that determine the amount of the payment. Third, in many OECD countries the level of support is already very high and this can potentially affect (likely reduce) the responsiveness to payments.

The main challenges for modeling the production response of “more decoupled” payments are not due to the technical structure of the model, but to the difficulty of finding robust and consistent empirical estimations of the response parameters that can feed simulation models. The need for this empirical work is accentuated by the complexity and the number of response mechanisms that can be identified. The technical difficulties for undertaking such sophisticated estimations have contributed to the scarcity of the empirical literature in this area, particularly for structural models. The lack of variability of total support levels and the use of quantitative restrictions that may prevent farmers’ response are also part of these difficulties. The absence of a control group of farmers not receiving the support is also signalled as a difficulty in Key et al. The explicit consideration of variables capturing the policy instruments and changes in policy regimes is a prerequisite for obtaining useful estimations of response parameters. The scarce empirical literature that has been published often deals with area response, leaving open the very relevant issue of yield response A review of the empirical literature in the US (Abler) reports only one published study on land response to US payments (Adams et al.). Most studies are focused on only part of the effects that are discussed in this article (Moro and Sckokai). Furthermore, some studies underline the uncertainties associated with the quantification of the yield response to area payments (Benjamin and Houée). There are also difficulties in building the bridge between the empirical results and the parameter needs of specific models. The production ratios and the corresponding degree of coupling / decoupling in Cahill and OECD (2001a) are attempts to overcome this difficulty.

How do models deal with “more decoupled” payments?

Driven by the demand from policy makers and negotiators, several models have tried to simulate the impact of agricultural policy reform in production and trade. The original focus of most of these models was trade and trade policy measures. However, the policy changes that have occurred in the last two decades have increased the relative importance of domestic measures of the “more decoupled” nature in the agricultural policy mix and models have often adapted their structure to capture some of these measures. There is scarce econometric evidence of the nature and scope of farmers´ response to these payments. Under this circumstance we must accept that simulation models cannot perform as well as we would like, and their stories are very much influenced by a set of assumptions about the impact of the new payments. These assumptions are often based on valuable "expert assessment", but rarely on true empirical evidence.

This section briefly discusses the representation of main domestic programs in a selection of simulation models: FAPSIM (Economic Research Service of USDA), FAPRI (Universities of Missouri and Iowa State), AGLINK and PEM (both from OECD), ESIM (EU Commission) and WEMAC (INRA). The sample of models does not pretend to be exhaustive (Table 2). They are all partial equilibrium models[4]. The information is based on the responses to a questionnaire sent to the modelers[5].

Table 2. Payments represented in selected models

	FAPSIM Linker (ERS)	FAPRI	AGLINK (OECD)	PEM (OECD)	ESIM (EC)	WEMAC (INRA)
EU 1992 Area Payments[1]	Yes	Yes	Yes	Yes	Yes	Yes
EU 2003 Single Farm Payment	No	Yes	Yes	Yes	No	No
US 1996 AMTA / 2002 Direct Payment	No	Yes	Yes	Yes	No	Yes
US 2002 Counter-cyclical Payments	No	Yes	Yes	Yes	No	Yes
Other Programmes	Indian wheat	EU new members		Mexican Procampo		

1. This heading refers to both the original 1992 payments and the 1999 reform.

What payments are included in these models? We focus our discussion on four "more decoupled" programs implemented by the main players in agricultural trade, avoiding the discussion about inclusion or exclusion from this list. The objective is to be illustrative, with no intended empirical or legal implication. The four programmes are the 1992 area payments and the 2003 single farm payment in the European Union, and the 1996 AMTA payments (called direct payments in the 2002 farm bill) and the

4. The OECD´s GTAP-PEM based on one of the most popular general equilibrium models (GTAP) follows a representation of land markets and "more decoupled" payments that is similar to the standard representation in PEM.

5. These questionnaires were sent to the economists in charge of the models on the occasion of an *ad hoc* World Outlook Conference held in Rome, May 2005.

countercyclical payments in the United States. All six models include a representation of the 1992 EU area payments (Table 2). The other three programs are just assumed to be fully decoupled (with no effect on production decisions) in FAPSIM and ESIM. The SFP is also considered as fully decoupled in WEMAC. FAPRI, AGLINK and PEM have a representation of some response to all these payments.

Land allocation and non price effects

Table 3. Elements in the land allocation structure of each model

	FAPSIM Linker (ERS)	FAPRI	AGLINK (OECD)	PEM (OECD)	ESIM (EC)	WEMAC (INRA)
Inputs represented in the model	Land and yields	Land and yields	Land and yields	Land + set of other inputs	Land + set of other inputs	Land and yields
Input substitution in production	No	No	No	CES	Yes	No
Market of land: demand and supply	Yes	1 land equation[1]	1 land equation[1]	Yes	1 land equation[1]	1 land equation[1]
Land heterogeneity for different uses	Yes	Yes	Yes	Yes	Yes	Yes
Idling	Yes	Compulsory exogenously	Endogenous voluntary set aside equ.	Compulsory exogenously	Compulsory exogenously	Exogenous

[1] One system of equations for land response, as reduced form of supply / demand interactions.

The land allocation system is a main modeling element and it is briefly described in Table 3. Most of the partial equilibrium models represent production of agricultural commodities by a combination of land and yield equations. The yield variable is assumed to summarize all the information about non-land inputs. Most of these models exclude the substitution between land and other inputs: a payment to land does not reduce the relative use of non-land inputs as we have theoretically argued. This is not the case of ESIM and PEM where input substitution occurs. Excluding area / yield substitution implies that a commodity specific area payment will be partially decoupled only if land response to area payments is weaker than land response to price support, which seems unlikely to occur. Land response is most often represented with a single system of land equations that summarize the interaction between supply and demand in the land market. The exception is the PEM model that has an explicit production function with a representation that is similar to some general equilibrium models like GTAP-PEM, with a CES production function that allows the substitution of land for other inputs. All models assume the heterogeneity of land with a system that accounts for the imperfect substitution of land for different uses. However, the empirical evidence on the degree of substitution in production between land and other inputs, and the degree of differentiation between different types of land is scarce[6]. Several models include in their standard work a systematic use of sensitivity analysis. This is a welcome improvement that helps understand the results, but which cannot substitute for an empirical estimation of the magnitude of these parameters, and their confidence intervals.

An important challenge raised by payments that allow voluntary idling or set aside is the representation of the land that is "idle" but receiving the payment in the land allocation system. All models include an exogenous representation of idling (compulsory set aside) or an implicit effect on land. The need for a good representation of the endogenous response of idling is exacerbated by the existence of some conditions attached to the land that is idled, but receives the payment. This land should be differentiated from land just leaving the sector. For instance, AGLINK has an endogenous voluntary set aside equation for the EU. The statistical identification of these two types of lands is not always well defined and the challenge of estimating "idling" supply and demand seems to be open.

Table 4. Representation of non-price effects

	FAPSIM Linker (ERS)	FAPRI	AGLINK (OECD)	PEM (OECD)	ESIM (EC)	WEMAC (INRA)
Cross Compliance	No	No	No	No	No[1]	No
Risk effects	No	No[2]	Yes[3]	Yes[4]	No	No
Wealth / Income effects	No	No[2]	Only risk related	Only risk related	No	No
Other effects	No	No	No	No	No	No

1. Maintaining land in agricultural use is included.
2. FAPRI uses a reduced form that it is assumed to capture risk and wealth effects. Lagged prices may capture some risk effects for counter-cyclical payments.
3. Risk premiums are calculated for countercyclical payments from truncation if price distributions.
4. There is a risk version of PEM that calculates risk premiums for main PSE categories having a significant effect in reducing farming revenue.

6 See, for example, OECD (2001b) for a revision of the empirical literature that is used for determining the parameter values in the PEM.

Cross compliance conditions that are attached to some of these payments, particularly the SFP, are excluded from the analysis despite their potential to affect relative incentives (Table 4). Their influence needs to be analyzed at the individual level before aggregating at the national level that is the geographical framework of analysis of these models. Risk effects are included in some applications of AGLINK and PEM, though the weakness of the empirical evidence about the coefficient of risk aversion to include in the equations is recognized. Risk effects are of relevance only for US counter-cyclical payments. Wealth / income effects (other than risk related that are typically estimated to be very small) and any other effects are absent in all models. Some models, like the FAPRI, have a reduced form approach that is difficult to interpret in terms of the precise type of economic effects it is designed to capture.

"More decoupled" programs in the European Union

The original EU 1992 area payments for crops are payments per hectare of land used for specific activities. The Agenda 2000 reform that aligned most of the rates of support and allowed some voluntary set aside introduced changes in the initial 1992 policy.

Table 5. Representation of the 1992 EU Area Payments

	FAPSIM Linker (ERS)	FAPRI	AGLINK (OECD)	PEM (OECD)	ESIM (EC)	WEMAC (INRA)
Commodities whose equations are affected	Cereals, oilseeds (beef)	Cereals & oilseeds (beef)	Cereals, oilseeds (beef)	Cereals, oilseeds (beef)	Cereals, oilseeds (beef)	Cereals, oilseeds
First incidence of the payment[1]	Additional returns per ton	GrainArea= f(AP),ε=0.02 Commodity area shares depend on AP	Cereals Area = f (returns + 0.267*AP) Beef Inv = =f(ret.+HP...)	Commodity area supply = f (Pa+AP) (substitution with other inputs)	Commodity area supply = f (returns + a* P…)	Impact on area equation ε = 0.06
Incidence on other land uses	Set aside	Set aside	Set aside	Set aside	Idling is an alternative	Set aside
Payment rates	Same per hectare	AP / ton * *Hist.Yield	Same per hectare (after 2000)	Commodity Specific rates (observed)	Same AP/ hectare	Specific historical rates
Eligible base limit	Yes	Not out of range	No	Yes in specific applications	No, but legal limits	No

1. When a functional formula is written, ε denotes the corresponding elasticity of area with respect to the payment "AP".

All models consider EU 1992 area payments as having an impact on production (Table 5). FAPSIM considers the payments as additional returns per ton (they are fully coupled), meanwhile the rest of models introduce area payments in the grain or cereals area equations with different elasticities. PEM adds the payments per hectare to the rental price of land received by land owners. The ratio of PEM production response to area payments as compared to price support is used to weigh the incidence of area payment on land returns in the AGLINK equations. Other land uses is only implicit in all models, except for compulsory set aside that is explicitly included as an exogenous shock (except in ESIM). The payment rate for different commodities can differ in most of the models, which is relevant for the cross effects among eligible commodities. The eligible area base limits are not represented in most of the models. FAPSIM is an exception and ESIM includes the legal limits for transferring land from one use to another, such as from pasture to crops.

The 2003 Single Farm Payment substitutes a large portion of the 1992 CAP payments (including livestock payments per head or per ton) by a new single farm payment largely independent of the agricultural activity conducted on the land. In general, the design of the SFP as farm level average of payments per hectare generates different rates per hectare for different pieces of land. However, the rate of payment for a given entitlement does not change for different land uses, including idling with an extensive list of cross compliance conditions. This hybrid between a flat rate payment and a payment rate differentiated by commodity introduces additional uncertainty about the magnitude of the cross effects of the SFP.

The SFP is assumed to be fully decoupled in half of the models (Table 6). The share of old CAP payments included in the SFP is used in all models to determine the amount of remaining old "partially decoupled" payments. FAPRI[7] applies a 0.75 coefficient to the payments in the land share equations. PEM expands the types of land uses that are eligible for the payment, including other arable land, and, therefore, reduces the possibility of substitution with alternative uses. AGLINK uses the smaller PEM production ratio of SFP to weigh their impact on cereal area equation. Compulsory set aside is explicit in all three

[7] FAPRI has two different models for the EU. The model described in this paper is the FAPRI-ISU model.

models, but voluntary set aside can only be interpreted as implicit, except in AGLINK. The chosen options on the rate of support are also different across models.

Table 6. Representation of the 2003 EU Single Farm Payment

	FAPSIM Linker (ERS)	FAPRI	AGLINK (OECD)	PEM (OECD)	ESIM (EC)	WEMAC (INRA)
Commodities whose equations are affected	None	Cereals and oilseeds (dairy)	Crops and Beef, Sheep and dairy	Land for crops, pasture and other	None	None
First incidence of the payment[1]		Grain Area= F(.75*SFP…) ε = 0.02 Commodity areas shares = f (.75*SFP..) ε = 0.038	Cereals Area = f (returns +0.11*SFP..) Beef Inv = = f (ret. + 0.06*SFP..)	Commodity area supply= f (Pa+SFP) (substitution with other inputs)		
Incidence on other land uses		Compulsory set aside	Implicit in non-homogeneity	Compulsory set aside & other arable		
Payment rates		Same SFP per hectare *0.75 * Decoupling ratio	Same SFP per hectare	Specific rates (observed)		
Eligible base limit		Not, but low supply elasticity	No	No		

1. When a functional formula is signaled, ε denotes the corresponding elasticity of area with respect to the payment "SFP".

"More decoupled" programs in the United States

In the United States the PFC payments of the 1996 FAIR Act, were substituted by the Direct Payments program in the 2002 Farm Bill. The program maintains its basic structure, even if a voluntary partial updating of base acres has been adopted with potential expectation effects about future updates (OECD, 2005). It is considered as fully decoupled by FAPSIM and ESIM, but incidence on land returns are modeled in the other four models (Table 7). FAPRI identifies this response with a wealth effect. In most cases a uniform rate per hectare is applied using historical basis and no limit is imposed to eligible land. The amount of the PFC payments was topped up since 1998 to cover for smaller market prices. This top-up payment was institutionalized in the counter-cyclical payments program in the 2002 Farm Bill.

Table 7. Representation of the US 1996 PFC and 2002 Direct Payments

	FAPSIM Linker (ERS)	FAPRI	AGLINK (OECD)	PEM (OECD)	ESIM (EC)	WEMAC (INRA)
Commodities whose equations are affected	None	Cereals and oilseeds	All grains and oilseeds	All crops and oilseeds and other ara.	None	Cereals and oilseeds
First incidence of the payment[1]		All land= f (.25* net coeff. on returns*DP..) ε ≈ 0.01	Commodity area supply = f (returns +0.09*DP)	Commodity area supply= f (Pa+DP) (substitution with other inputs)		Impact on area equation
Incidence on other land uses		Only implicit	Not explicitly	Idling is under other arable land		Not explicitly
Payment rates		Same rate per hectare	Same rate per hectare	Historical average rates		Historical rates
Eligible base limit		No, but low supply elasticity	No	No		No

1. When a functional formula is signaled, ε denotes the corresponding elasticity of area with respect to the payment "SFP".

FAPSIM and ESIM consider these counter-cyclical payments as fully decoupled. WEMAC considers the same impact as direct payments (Table 8). FAPRI models an additional response as compared to the "decoupled" component already considered for the direct payments. This "coupled" component is attributed to insurance and policy expectation effects, and it almost doubles the response to these payments as compared to direct payments. AGLINK also adds to the "price" component of direct payments a risk component that is estimated from the truncation of price distributions. Similarly, the PEM model considers a risk reducing effect on price premiums additional to the effect on land prices.

Table 8. Representation of the US 2002 Counter-cyclical Payments

	FAPSIM Linker (ERS)	FAPRI	AGLINK (OECD)	PEM (OECD)	ESIM (EC)	WEMAC (INRA)
Commodities whose equations are affected	None	Cereals, Oilseeds and Cotton	All grains and oilseeds	All crops and oilseeds and other arable	None	Cereals and oilseeds
First incidence of the payment[1]		"decoupled" component = (.25* net coeff.on returns*CCP..) "coupled" component= 0.25*CCP(EP) (by **commodity**)	"Risk" component= Risk price premium "Price" component= f (returns +0.09*DP)	Variance Land price		Same as in direct payments
Incidence on other land uses		Only implicit	Not explicitly	Idling is under **other** arable		Not explicitly
Payment rates		Commodity specific rates (E(CCP))	Same CCP/h Different risk premium	Historical rates		Historical rates
Eligible base limit		Not, but low supply elasticity	No	No		No

1. When a functional formula is signaled, ε denotes the corresponding elasticity of area with respect to the payment "CCP".

The degree of decoupling of different programs

This is a complex panorama of imperfect *ad hoc* second best solutions to modeling payments whose incidence on farmers' response remains an open empirical question. The assumptions in each model have implications about the response to additional support through each program, and the relative impact as compared to price support (the production ratio as defined in Cahill and OECD, 2001). The numerical value of these production ratios is very sensitive to the details of calculation and, therefore, the ratios in Table 9 are merely illustrative of the large different implications and assumptions across models. Assumptions, policy representation and response can also change for different applications of the same model. For instance, the response to Counter Cyclical Payments is typically contingent on expected prices and variability. The response to prices in each model also affects the value of the denominator in the ratio.

Therefore, this information should not be used as an assessment of the degree of decoupling of each program.

There are good economic and empirical reasons to argue that these payments are "more decoupled" than price or output support. There are also good reasons to argue that the SFP is more decoupled than the 1992 EU area payments program, and the US Direct Payment is more decoupled than the Counter-cyclical Payments. Any further step on quantifying the degree of decoupling and the expected response to these payments would need further empirical evidence and work on comparability.

Table 9. Implied approximate estimated degree of coupling / decoupling[1]

	FAPSIM Linker (ERS)	FAPRI	AGLINK (OECD)	PEM (OECD)	ESIM (EC)	WEMAC (INRA)
EU 1992 Area Payments	**1**	**≈ 1.00**	**< 0.27**	**0.27**	**(0 , 1)**	**(0 , 1)**
EU 2003 Single Farm Payment		**≈ 0.60**	**< 0.11**	**0.11**	**0**	**0**
US 1996 AMTA / 2002 Direct Payment		**≈ 0.34**	**< 0.09**	**0.09**		**(0 , 1)**
US 2002 Counter-cyclical Payments		**≈ 0.59**	**< (0.09+**Risk)	**?**		**(0 , 1)**

1. These numbers are calculated as production ratios: increase in production per dollar of additional payments as compared to the increase in production per dollar of additional price support (OECD, 2001). Calculations in this table are sensitive to the details of the experiment design and are approximate with the purpose of illustrating the range of potential available assumptions only. When no calculation was available but the magnitude could be inferred as the interval (0 , 1), this interval is shown in the table and represents partial decoupling. When the modeler makes no claim of representing a given program, the cell is left empty.

Conclusions and further needs

Economists have to be aware of the limitations of their analysis. There are many things we do not know about the quantitative response to "more decoupled" payments. Unfortunately, the simulation work to date is weakened by the scarcity of the econometric evidence in this area. But simulation exercises with these models are and have been useful. If they are done and interpreted with the maximum rigor, these exercises help to understand the implications of reforms and develop the empirical agenda required to quantify their impact. They are also second best approaches to quantifying these impacts, under the constraints imposed by the current state of knowledge and art.

The lack of a body of empirical literature on farmers' response to "more decoupled" payments implemented in several countries is surprising and regrettable, because it imposes limitations on the analysis of the consequences of what is probably the most important agricultural policy change that has occurred in decades. But there is room for being optimistic. There are some very recent studies that are improving our empirical knowledge of the response to these payments in the European Union and the United States (Sckokai and Antón, Goodwin and Mishra 2005a and 2005b, and Key, Lubowski and Roberts). They use mostly micro data with different approaches. Agricultural economists and research institutions should learn from this experience. There are important potential gains from devoting more resources to generate the appropriate data (often micro data) and facilitate and promote the econometric analysis of response to "more decoupled" payments using these data. Some effort is also needed to facilitate the comparability of empirical results and to build the bridges between these results and the parameters needed in simulation models. If these payments continue to be provided per hectare, special efforts should be dedicated to the empirical knowledge of land markets, their interaction with yields and their representation in simulation models.

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