Decoupling:

The concept and past experiences

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Abstract

This study examines the concept of decoupling, and exemplifies with practical experiences by reviewing previous research. A number of potential links between different types of agricultural support and output have been identified in the literature. Support that affect incentive prices give raise to price and cross-subsidation effects. Beside these two effects, support to the agricultural sector may induce indirect effects, which include income effects, risk related effects and dynamic effects. The practical experiences with decoupling have been mixed. The general pattern is however that the support has changed away from the most distorting measures. This is an indication that the URAA have been important. The review of previous research has revealed the need for further research on the effects of agricultural support on production and trade. Particularity the indirect effects of agricultural support need to be further examined.

Introduction

Agricultural production has a long tradition of being supported financially by governments. Along, voices have been raised arguing that agricultural production should not be subsidised, as this gives rise to welfare losses. However, the production distorting support has prevailed. The discussions on agricultural products in the General Agreement on Tariffs and Trade (GATT) and later World Trade Organisation (WTO) negotiations has given support to the idea that production should not be subsidised. In 1993 an agreement on agricultural production was reached in the Uruguay Round Agreement of Agriculture (URAA). The URAA attempts to limit trade-distorting support. The political efforts since the early 1990s of cutting the links between support and production has also given rise to research on the subject of decoupling.

This paper provides a review of research on the concept of decoupling. Research in the area is vast, and covers a wide variety of aspects linking agricultural support directly and indirectly to production. The purpose of this paper is not to completely cover all this research, but rather to describe the concept and its theoretical implications along with examples and discussions of experiences of agricultural policy reforms involving decoupled subsidies. The focus on the empirical work is, hence, in the first place, on ex post studies of existing reforms, albeit being aware of models simulating the effects of future reforms.

The word decoupling is, as noted in e.g. OECD (2001a), widely used, with various interpretations depending on the situation. It can be regarded as means to continue with income support to the agricultural community with less or no distortions on production. It can also intend to be a transition policy towards a more market oriented agricultural business. In another aspect, it needs not be a reform of existing agricultural support, but an introduction of a new transfer policy, which is less decoupled than price support. This is, for example, the case in the new EU member states from Eastern and Central Europe, where this type of income support to farmers will be a new experience. The lack of consistency in the use of the term decoupling is probably partially due to a lack of a common definition of the concept, which calls for caution in the use of this term. Later in this paper different definitions are discussed.

With reference back to the introducing paragraph, why do governments still pay subsidies to agricultural production? Economic theory suggests that production should

not be subsidised as, in general, subsidies induce negative welfare effects. This is also the core argument for free trade and the motivation for non-subsidised agricultural exports in the WTO documents. However, the fact that the agricultural sector is already subsidised, at least imply that support cannot be removed without transition rules. Historically, various reasons for the existence of support to agricultural production have been put forward. For example Keeney and Kemp (2002) have described how the agricultural support started in the US with the need of export revenue after the revolutionary war. In EU the common agricultural policy (CAP), introduced 1962, was formed in the years after the Second World War, when ensuring the supply of agricultural products was at the forefront of the agenda. Later, both in the US and in the EU, support programs were formed with the purpose of creating a sustainable agricultural society, which includes providing support to low income farmers. A recent chronology of agricultural policies can be found in e.g. Baffes (2004), and further, a discussion on to what types of farms receive support can be found in Prodbury (2000).

The perhaps most appealing argument for supporting farmers is, as pointed out by Beard and Swinbank (2001), that as a consequence of existing agricultural policies farmers have been led to invest in certain areas, and it may be problematic to suddenly remove agricultural support that could lead to bankruptcies in the agricultural sector. However, there is also a political dimension explaining the existence of the supports. Support to agricultural business is often legitimated by the argument that small family farms need income support in order to secure a fair standard of living. The provision of agricultural products at reasonable prices to consumers is also a supportive argument. It should however be noted, that despite the history of support, it is not impossible to deregulate the agricultural sector. An example of this is the reform in 1984 in New Zealand, where nearly all agricultural support where removed while the farmers who decided to leave the farming business received an exit grant of approximately two thirds of the annual income. The World Bank (2003) has concluded that the policy has lead to a more diversified and sustainable rural economy.

The idea that agricultural production should not be subsidised, and that support to such production should be removed, is not new. Proposals of decoupling agricultural policies have been seen in the agricultural economics literature for a long time. Swerling (1959) argued for decoupling of the US agricultural policy, and Nash (1961 and 1965)

proposed a decoupled policy for Europe. Such proposals can be found in e.g. Beard and Swinbank (2001), and Baffes (2004).

Having accepted the fact that agricultural support exists, with the primary purpose to provide income support to the farm household and is likely to be for the foreseeable future, the question is how to provide it at a minimal welfare loss. That is, to provide support at lowest cost, and with the least distortions. The solution proposed in economic theory is lump-sum transfers, which would not give raise to welfare losses as opposed to price support or input based subsidies. However, for the lump-sum transfer to be welfare improving compared to quantity based support it must be made without transaction costs. The financing must be free, i.e. no distortions from taxes are allowed to arise, and finally, there cannot exist any positive external effects or collective goods in connection to the production. The assumption that these restrictions hold is highly restrictive, as pointed out by OECD (2001a). Disturbances and welfare effects from taxation and decoupling have been discussed by e.g. Parry (1999) and Moschini and Sckokai (1994). Moreover, welfare effects from different scenarios of decoupling have been examined by e.g. Renwick et al. (2003).

Different aspects of welfare can be examined when analysing decoupling, and one important question is to analyse the changes in output induced by the support. This study focuses on the production effects of payment programs, while transaction costs, public goods and cost of taxation will not be further discussed. The effects on production from subsidies are also central in the URAA, which together with the negotiations, as stated before, is one important driver for policy reforms. Note also that the WTO continue the work with agricultural support. By August 1, 2004 an agreement was reached on a framework for reducing agricultural support and protection within the Doha Round negotiations (Agra Europe 2004b).

The study is organised as follows. First, the concept of decoupling is discussed, and a simplified static model, that is basically the starting point for many of the studies discussed later in the paper, is presented. Second, different definitions of decoupling are discussed. Third, different types of support and their potential impact, through direct and indirect links, on production are described. Fourth, some practical experiences with decoupling of agricultural support in e.g. the US and the EU are described. Further,

conclusions from empirical studies on these reforms are presented and briefly discussed. Finally, the last section concludes the study.

The Concept of Decoupling

A policy, or a package of policies, is said to be decoupled if it has no, or small effect on the level of production and trade. In theory, the decoupled policy has no effect on output, while the coupled policy will affect the level of production. For example a policy that is constructed eliminate price changes confronted by the farmer is fully coupled if it totally offsets the price change.

The effect on production refers to the impact of an existing policy, i.e. income support, compared to the case without any type of support. It does not refer to the effects that might arise as a consequence of a policy change. This means that a change from a to some degree coupled policy to a more decoupled policy would, *ceteris paribus*, have an effect on the level of production.

An Introductory Model

The basis for the majority of the work in the area of decoupling is a basic model, representing a static world with no uncertainty. Consider a utility profit maximising producer (see e.g. Chambers and Just, 1989 and Moro and Sckokai, 1999) where the producer faces a technology described by a netput vector q, with output and input quantities, and a price vector p, with output and input prices. Profits also depend on the level of support from the government, $g(\beta)$, where β is the amount of support. The optimisation problem of the producer is thus to maximise a profit function

$$\pi(p,q,g(\beta)) = pq + g(\beta)$$

The profit function is non-increasing in input prices and non-decreasing in output prices. The farmer's optimisation problem is

$$\max U(\pi(p,q,g(\beta))).$$

Netput supply follows from Shepard's lemma under the assumption that the profit function is twice differentiable.

$$q(p, g(\beta)) = \frac{\partial \pi(p, q, g(\beta))}{\partial p}$$

This allows us to analyse the change in production by taking the total derivative of *q(.)*:

$$dq(.) = \frac{\partial q(.)}{\partial p} dp + \frac{\partial q(.)}{\partial g(\beta)} dg(\beta)$$

Next, define the price elasticity as $\varepsilon = \frac{\partial q(.)}{\partial p} \frac{p}{q(.)}$ and the payment elasticity as $\phi = \frac{\partial q(.)}{\partial g(.)} \frac{g(.)}{q(.)}$, which allows us to write

$$\frac{\partial q(.)}{q(.)} = \varepsilon \frac{dp}{p} + \phi \frac{dg(.)}{g(.)}$$

hence, the percentage change in produced quantity depends on changes in both netput prices and government payments, i.e. changes in the level of support. Also note that the support function *g(.)* can be modelled in different ways. It can be dependent on the level of production this or previous year, the land use etc.

Sckokai and Moro (2002) have extended the model with uncertainty, and in OECD (2001b) a dynamic version of this model is found.

Definitions of decoupled policies

Decoupling is a term that, as noted above, can have somewhat different interpretations, which might be a consequence of the lack of a standard definition in the literature. Spriggs and Sigurdson (1988) have offered the easiest definition by simply stating that: "In fact, a program to eliminate subsidies would be the ultimate decoupling. It is the only truly decoupled program that there is." Amongst those who discuss decoupling in

policy programs that allow for payments, a fundamental difference between two types of definitions is whether a policy is defined as decoupled *ex ante*, as e.g. in the 'legal' definition in the URAA, and by Burfisher and Hopkins (2003), or *ex post* as by e.g. Cahill (1997). The later definition has also been adopted by the OECD (2001a).

The *ex ante* definitions are criteria based, and the URAA provides a list, presented below, of five criteria that payments should meet to be defined as decoupled. Another criteria based definition can be found in Burfisher and Hopkins (2003), who argue that the only subsidies that are decoupled are those that do not *depend* on prices, factor use, or production. However, the criteria based definitions give no guarantee that the support does not influence production *ex post*. Cahill (1997), on the other hand, argues that a policy, or a policy package, is decoupled if it does not *affect* the level of production. The *ex post* definition is consequently based on the outcome of the policy.

Decoupling according to the WTO

Policy measures are considered decoupled, i.e. included in the so called 'green box', in the URAA if they meet the five criteria listed in Article 6 of Annex 2 to the URAA.

Annex 2 of the URAA:

1. Domestic support measures for which exemption from the reduction commitments is claimed shall meet the fundamental requirement that they have no, or at most minimal, trade-distorting effects or effects on production. Accordingly, all measures for which exemption is claimed shall conform to the following basic criteria:
(a) the support in question shall be provided through a publicly-funded government programme (including government revenue foregone) not involving transfers from consumers; and,
(b) the support in question shall not have the effect of providing price support to producers;

plus policy-specific criteria and conditions as set out below.
…
6. Decoupled income support
(a) Eligibility for such payments shall be determined by clearly-defined criteria such as income, status as a producer or landowner, factor use or production level in a defined and fixed base period.
(b) The amount of such payments in any given year shall not be related to, or based on, the type or volume of production (including livestock units) undertaken by the producer in any year after the base period.
(c) The amount of such payments in any given year shall not be related to, or based on, the prices, domestic or international, applying to any production undertaken in any year after the base period.
(d) The amount of such payments in any given year shall not be related to, or based on, the factors of production employed in any year after the base period.
(e) No production shall be required in order to receive such payments.

The eligibility of the 'green box' has been criticised, as pointed out by Gohin and Guyomard (2000), who refer to arguments in USDA (1998) and by Tielu and Roberts (1998). USDA (1998) stress that "a problem of interpretation arises in implementing the URAA because of the undefined fundamental criteria for the green box that the reported programs be no more than minimally distorting on production and trade. Consequently, some programs reported in the green box could satisfy the policy-specific criteria for being green and yet also could have significant production effects with great enough financing and program participation." Tielu and Roberts (1998) add: "although the green box measurers are supposed to be minimally production distorting, there could be substantial scope for reorienting support towards the measures in ways that could markedly increase production".

The two types of definitions induce that the word decoupling is used differently. A study that defines a policy as being decoupled based on criteria, and thus independent of its effect on output, can e.g. in an ex post econometric analysis of this policy reach the conclusion that the decoupled policy have affected the production decision. This would, on the other hand, be a contradiction with the definition stated by Cahill (1997), as the policy there is determined to be decoupled or not, on basis of its effect on production.

Evaluation of the impact of policies becomes particularly interesting when policies are evaluated as packages. Cahill (1997) argues that since policies exist in a political and economic environment, they should not be evaluated on an individual basis. The total effect of a package of policies need not be the sum of the isolated effects of the single policies. A package of policies might have a small or zero net effect, even though the single policies might have significant effects on production. This has further been discussed by Gohin et al. (2000). They show analytically that policy measures may exhibit different degrees of decoupling in different sectors and regions, depending on production technologies and factor mobility. The analysis also reveals that the impact of the policy depend on how many sectors it is implemented in, and whether other policies are implemented jointly. Thus, this suggests that policies should not be judged separately, but as part of a policy package. Empirical studies of the 1992 and Agenda 2000 CAP reforms by Cahill (1997), Moro and Sckokai (1999), and Gohin and

Guyomard (2000) also support this result. Thus, the URAA or WTO definition may also be criticised on the basis that it treats policies individually.

Thus, it can be discussed whether the URAA definitions actually would limit the impact of payments on output. However, Tangermann (2003) show that the URAA has become important in the policy formation process. He argues that "There is no doubt that the Uruguay Round negotiations have been a success, not only in the sense that a new legal framework for agricultural policies at the international level was finally agreed, but also in the sense that countries have, by and large, lived up to the new rules and commitments."

Outcome based definitions of decoupling

Cahill (1997) argues, that a package of policies should be considered decoupled based on the effect is has on production. Based on this criterion four levels of decoupling are defined ranging from fully coupled to fully decoupled. Further, he proposes an index of the degree of decoupling for empirical use.

A *fully decoupled* policy does not influence production decisions by the farmers, and permits free market determination of prices. This definition is based on Warely (1988, p.1) and Rausser and Foster (1987, p. 18). Another way of putting it is to state that the supply and demand functions are left unchanged when a policy package is introduced (OECD, 2001a). Turning back to the model presented earlier, full decoupling implies that a change in production only corresponds to a change in prices, thus a change in payments have no effect at all. In the model this can be stated as

$$\frac{dq(.)}{q(.)} = \varepsilon \frac{dp}{p} + \phi \frac{dg(.)}{g(.)} = \varepsilon \frac{dp}{p} \qquad \text{full decoupling}$$

Note that when analysing packages of policy, rather than a single policy, this implies that the net effect of the package on the level of production is zero.

As a policy is unlikely to be fully decoupled in reality a weaker definition is also proposed. An *effectively fully decoupled* package "results in production that for any product, does not exceed the level that would exist without compensation" (Cahill, 1997 based on Roberts et al., 1991). This is, as also noted in OECD (2001a) an asymmetric

definition. Under this definition an additional payment linked to production is coupled, but a reduction of the payment is decoupled. Thus, measures that have a negative effect on production will be considered decoupled.

To further relax the strength in the definitions a *partially decoupled* package "results in production that, for any crop, exceeds the level that would exist without compensation but does not exceed that which would exist if the package were fully coupled to production" (Cahill, 1997).

Finally, *full coupling* means that the payment scheme has full effect on the change of the quantity. Depending on the purpose of the policy different results are expected. First assume a payment scheme that is independent of price changes. Formally, the fully coupled policy imply that

$$\frac{dq(.)}{q(.)} = \varepsilon \frac{dp}{p} + \phi \frac{dg(.)}{g(.)}$$

Thus both changes in prices and in government payments will affect quantities. Obviously, if prices are kept constant the whole change in quantity would emanate from changes in payments, i.e. $\frac{dq(.)}{q(.)} = \phi \frac{dg(.)}{g(.)}$. In the case of a policy aimed at compensate for price changes, the fully coupled policy perfectly offsets a price change. Again returning to the model, Moro and Sckokai (1999) in their modelling attempt of the effects of the Agenda 2000, the change in output as a consequence of a change in prices and policies will be stated as

$$\frac{dq(.)}{q(.)} = \varepsilon \frac{dp}{p} + \phi \frac{dg(.)}{g(.)} = 0 \qquad \text{full coupling}$$

Thus, a fully coupled package will totally restore the price change.

In reality, it is unlikely that one is able to observe full coupling or decoupling. It would, thus, be desirable to see how decoupled or coupled a policy is. Cahill (1997) has derived an empirical measure called the *degree of decoupling* (DD) or *the rate of decoupling*. In the model by Moro and Sckokai (1999), the degree of decoupling can be

defined as the fraction of the effects of a coupled and a decoupled policy, that is

$$DD = \frac{\varepsilon \frac{dp}{p} + \phi \frac{dg(.)}{g(.)}}{\varepsilon \frac{dp}{p}}. \text{ This can also be written as } DD = 1 + \frac{\phi \frac{dg(.)}{g(.)}}{\varepsilon \frac{dp}{p}}$$

This index takes the value 0 in the case of full coupling and 1 in the case of full decoupling.

In this study, decoupling is used along with the definition by Cahill (1997).

The Economics of Decoupling

This section aims at presenting links between support and production that have been identified in the literature. The effects from policy measures on production can broadly be categorised into *direct effects* and *indirect effects*. Direct effects arise as a consequence of changes in incentive prices or by quantitative restrictions. Indirect effects arise broadly as a consequence of, or expectations of, changes in income and wealth. The following sections will analyse effects grouped in these categories. It should however be noted that the classification of effects is not self-evident. OECD (2001a) e.g. has categorised effects into three groups: *static effects*, *risk related effects* and *dynamic effects*. For discussion on these see e.g. OECD (2001a) and Gohin et al. (2001). Of these, the risk related effects and the dynamic effects are indirect effects. Static effects on the other hand consist of both direct and indirect effects. Price effects and cross-subsidation effects are direct effects, while the income effect is an indirect effect.

The effects are cumulative and can occur simultaneously (this is independent of how the effects are grouped). In general, policy changes imply two kinds of adjustment in the agricultural sector, changes in the quantities produced, and the entry and exit decisions of farmers.

After the MacSharry reform 1992 in EU, and the FAIR Act 1996 in the US, numerous studies have focused on modelling the reforms. However, as noted by Moro and Sckokai (1999), the early research effort was devoted to the technical nature of the new policy instruments e.g. Fraser (1993 and 1997), Froud and Roberts (1993),

Nardone and Lopez (1994), Roberts et al. (1996), and Rygnestad and Fraser (1996). Later studies however, have been more focused on measuring the effect of a policy on output and trade. Most studies up to now have focused on the *static effects*. Theoretical contributions include e.g. Chambers and Just (1989), Moro and Sckokai (1999) Gohin et al. (2000 and 2001). The focus among these studies has been on the price effects, thus the effect on area allocation or planting decisions induced by changes in incentive prices. Early studies e.g. Guyomard et al. (1996), Oude Lansink and Peerlings (1996), Lin and Washington (1997), and Lin et al. (2000) measure the "supply response effect". Beginning with Cahill (1997) the rate of decoupling is estimated.

Studies beginning with Hennessy (1998) have elaborated on analyses under uncertainty, where followers, such as OECD (2004a), have measured the magnitude of *risk related effects*. The importance of the *dynamic effects* is the least explored area. The research efforts so far, have been on examinations of the effects on investment. The importance of expectations, however, remains to be explored, much due to difficulties in empirical examinations of such effects. In an ongoing program, the OECD is presently examining the risk related and the dynamic effects, including the role of expectations.

Direct effects of policies

Support to agricultural production has been categorised by OECD (2000) in the Policy Evaluation Matrix (PEM), where the Producer Support Estimate (PSE) indicates the monetary value of transfer to farmers as results of agricultural policy. The effect of the five PSE categories on production, trade and income has further been simulated and compared in OECD (2001b). The PSE categories include *market price support; payments based on output; area payments; payments based on variable input;* and *payments based on historical entitlements (lump-sum payments)*. Welfare, production and trade effects of different types of support have also been analysed by e.g. Gohin et al. (2001).

The following sections contain a discussion on the direct effects, i.e. price effects and cross-subisidation effects, on production and trade from the five categories of support. Furthermore, the effect of quantitative restriction is discussed. Thereafter,

indirect effects, i.e. income effects, risk related effects and dynamic effects, on production as a consequence of such support are discussed.

Price support

The impact of a supported, or guaranteed, price is well known from the economics textbook. This type of support is clearly coupled to production, as in the case of a net exporting country it simultaneously reduces demanded and increases supplied quantities, and thus increases traded volumes. The welfare loss, represented by Harberger triangles, is well known. The higher price decreases consumer surplus and increases producer surplus, but at the cost of taxpayers which induce the overall welfare loss.

The guaranteed market price induces what is known as a *price effect*. Whenever a policy creates a change in incentive prices on inputs and/or outputs, production and trade are affected. The price support would create a gap between domestic and world prices. This type of effect is not exclusive for the price support. Input and output subsidies, as well as area payments induce price effects. This is true even when the price of land is a shadow price and not a market price, OECD (2001a).

It should also be noted that *cross-subsidation effects* are potentially important. If prices are changed on commodities that are substitutes in production or in input use, then the allocation of land and other inputs can be changed. Thus, the whole set of prices that can have cross supply effects should be taken into account, as argued by Cahill (1997). The cross effects are however expected to be smaller the wider the program is in terms of commodities covered (OECD, 2001a).

Input subsidies

Payments based on variable input use, such as fertilisers and pesticides, are obviously coupled by construction, and induces *price effects*, as the subsidy creates a gap between prices paid by the producer and the prices on the factor market, and *cross-subsidation effects* on output, as discussed above. When it comes to comparing effects on output from input subsidies with price support, the outcome is not obvious. OECD (2001b) simulations show that this type of subsidy may induce larger effects than the price support. One explanation of this is that price support can be viewed as a subsidy to all kinds of input. An input subsidy is directed to the inputs that are most elastic in supply,

as compared with e.g. arable land. This type of support has, however, not been used frequently within OECD countries.

Output subsidies

Support provided based on produced quantities are generally thought of as being less market distorting than the guaranteed market price, since only producers are affected while consumers are not. Direct effects on production are, as above, categorised as *price effects* and *cross effects*. The price effect is induced of the gap between producer and consumer prices. A subsidy to producers that gives the producer the same price as in the case of price support would increase the net welfare of the producer, while the taxpayers bear the cost. However, as consumers are unaffected the only welfare loss incurring is related to the increase in supply.

OECD (2001b) simulations indicate that the difference between price support and output subsidies are small. When comparing output subsidies with subsidies based on variable inputs, the input subsidy thus have a larger effect on output. The differences can be explained in a similar manner as for the price support. The output subsidy can be viewed as an input subsidy equally eligible for all types of inputs, thus the input subsidy will generally be directed to inputs with higher supply elasticity.

Area payments

Area payments with requirements to plant are technically an input subsidy. Thus, both a *price effect* and a *cross-subsidation effect* may occur. The effect on production compared to subsidies based on variable inputs is however expected to be small. The expected difference is due to the low elasticity of supply on land. As the total supply of arable land in the aggregate agricultural business is limited, or can only increase at extremely high costs, the possibility to increase planted area is limited. Thus, effects on output and trade from this kind of support are expected to be low, which was also confirmed in OECD (2001b).

Quantitative restrictions

Price support, input and output based subsidies and area payments can be combined with quantitative restrictions, or quotas, in order to avoid or mitigate price effects and cross-subsidy effects. Environmental measures aimed at constraining the use of some

inputs also fall into this category. If quantitative restrictions on production were combined with any of the types of income support then the policy package would incur no production effects or welfare losses. Thus, the effect of what can be called a production quota-subsidy is very similar to lump-sum transfers (Gohin et al., 2001). If the production quota is determined at the free trade supply quantity then the support would not disturb the free trade equilibrium and would thus be regarded decoupled in an ex post study in the manner of e.g. Cahill (1997).

Lump-sum transfers

According to textbook economics, a payment based on historical entities with no requirement of production overcomes the problems with production distortions discussed above, in terms of *price effects* and *cross-subsidation effects*. Thus, in the framework of agricultural support, this is regarded as decoupled. However, a caveat is in place. Indirect effects, such as income effects, risk related effects and dynamic effects might create links between this type of payments and the level of production.

Indirect effects

Besides the direct effects that mainly appear through the construction of the payment program and often goes via the base for payments, indirect links between payments and production might arise. These effects occur of one main reason. The farm household becomes wealthier as a consequence of the payments, which induce changes in the factor supply from the household but also factor demand, and further, investment may be affected. The effects have been categorised in *income effects, risk related effects*, and *dynamic effects*. Note that these effects may occur as a consequence of all types of support discussed above. Moreover, the effects are cumulative and occur simultaneously, in addition to the price and cross-subsidation effects discussed above.

Income effect

The *income effect* is a potential link between payments and output as a consequence of behaviour induced by increased income. This effect is plausible under all five types of support discussed above. Gohin et al. (2001), show in a model with fixed capital and land but variable labour, that a farmer with no off-farm labour supply would reduce his

supply of labour on the farm, and thus output, as a result of received or increased income support.

Further, this effect has been shown by Benjamin (1992) to occur only when labour markets are imperfect. Using a farm household model Benjamin concludes that perfect labour markets imply that production and consumption decisions are made separately, and thus, payments would have no effect on output through this link. The farmer has the option to hire himself, his family or outsiders to work on the farm. However, imperfections as e.g. constrained off-farm employment or a wage gap between on-farm and off-farm returns will restrict the farmer's options and thus potentially create an income effect (OECD, 2001a).

To what extent this effect is important is an empirical question, which remains to be further examined. OECD (2001a) argues that from the point of view of aggregate effects, in most OECD countries labour markets imperfections are expected to have a limited effect. However, a caveat might be in place. Labour market imperfections may differ among countries, and might be more likely to be present in e.g. the new Member States in the EU, or countries like Mexico and Turkey, which have reformed their agricultural policies recently.

Further, if production is required for being eligible for receiving a support a potential link to produced quantities occur. The payments can affect the farmers' exit and entry decisions. Ghoin et al. (2001) show that a *cross-subsidation effect* may occur. Consider a producer who makes a loss at current market prices, and thus would exit the farming business. Assume that e.g. a fixed lump-sum payment, based on historical production, and that require production today, totally offset the loss. Then the *cross-subsidation* mechanism occurs and the farmer will remain in business.

Risk related effects

Farmers have so far been assumed to be risk neutral, or to act in a world without uncertainty regarding yield or market prices. In the following sections, this assumption is relaxed, i.e. uncertainty is introduced into the model. The assumption of risk averse producers affects the level of output in an uncertain environment, as shown by Sandmo (1971) and Chavas and Holt (1990).

There are two reasons why risk affects production. First, risk averse producers may reduce input use if production becomes more risky. Reduced input use results in

lower produced quantity. An intuitive explanation why a risk averse producer will choose to use less inputs (reduce intensity in production) is that reduced intensity means lower costs and therefore also may imply lower risk of low income in periods when revenue from products sold is low (due to for example low product prices or low crop yields). Even though reduced intensity at the same time implies lower income in good years, one Euro lost in a bad year is worth more than one Euro gained in a good year if the producer is risk averse. The second reason why risk may affect production is that risk averse producers can diversify production in order to reduce income variability. Diversification, or change of product mix, is a feasible strategy to reduce risk if for example crop yields or product prices for different crops follows different variability patterns.

Empirical evidence supports the view that agents are risk averse, as noted by e.g. Hansen and Singleton (1983), Wolf and Pohlman (1983) and Chavas and Pope (1985). For summaries of recent research on risk preferences see e.g. Knight and Coble (1997) and USDA (1999). The degree of risk aversion is often assumed to decline with wealth, i.e. individuals exhibit decreasing absolute risk aversion (DARA) preferences. This assumption has been confirmed empirically by Chavas and Holt (1990).

In an uncertain environment, a risk averse producer provides less output compared to a risk neutral producer. Both the degree of uncertainty and the producers' attitude towards risk affect the level of output. The potential link between income support and output is thus related both to the degree of uncertainty faced by the producer, and to the degree of risk aversion. Based on the work by Sandmo (1971) and Chavas and Holt (1990), the effects of agricultural support on output in an uncertain world have been derived by Hennessy (1998). As income support affects wealth, it has also a potential effect on the producer's acceptance of risk, which gives rise to the *wealth effect*. Further, a payment that reduced the degree of uncertainty faced by the producer induces an *insurance effect*.

The *wealth effect* occurs as government income support increases the wealth of the farm household, which is willing to accept a higher degree of risks at this higher wealth level. According to Sandmo (1971), this increases the level of production. Sandmo (1971) and Pope and Just (1991) have shown that constant absolute risk aversion (CARA) preferences do not alter production decisions. Hennessy (1998)

showed that DARA preferences are sufficient to ensure that wealth affects the preferences, such that the farmer would increase investment.

The *insurance effect* refers to additional production induced by the reduced uncertainty faced by the farmer. Payments that are contingent on an uncertain variable, e.g. the market price, and are constructed to mitigate its fluctuations, will thus reduce the level of risk that is confronted the to producer. When the degree of risk decreases, a risk averse producer will increase production. Hennessy (1998) concludes that to remove the insurance effect, support must be invariant to the source of randomness.

Furthermore, OECD (2001a) points at possible insurance effect of boarder measures. Boarder measures isolating domestic markets from fluctuations in world markets can have production effects in an uncertain world with risk averse producers.

There is one important difference between the wealth and insurance effects, as noted by Goodwin and Mishra (2002). While the wealth effect may occur for a support that in every other aspect would be regarded decoupled, the insurance effect only occur if, as stated above, the payment is made contingent on an uncertain variable.

It could also be noted that the positive effects on production from wealth and insurance effects, as proposed in the neoclassical framework by Sandmo (1971) and Hennessy (1998), have been challenged in work by e.g. Fraser (1988), based on the Newbery and Stiglitz (1981) labour supply model. Quiggin (1991) has examined this contradiction, and finds the explanation again to be in the assumptions of the labour market. Assuming labour market imperfections represented by a gap between on-farm and off-farm labour then income support will have a negative effect on production.

Which of the models above that are the most appropriate one is an empirical question as stated in OECD (2001a). Differences among countries may occur. The new member states in the EU may suffer from higher labour market imperfections than the rest of OECD countries. An example is Poland where the unemployment rate in 2001 amounted 17.5 percent (Polish Official Statistics 2002), which indicate imperfections in the labour market. Thus, one may expect different relationships between support and production in different areas within the EU, which make predictions about effects of decoupling the CAP more insecure.

Empirical examinations of wealth and insurance effects

A natural question is what magnitude the risk related effects have. Hennessy (1998) has applied his model in a simulation of the US loan rate and price target programs on a corn and soybean farm in Iowa. The results suggest that the wealth effect is small, while the insurance effect dominated the price effect. Further, in related studies, Mullen (2001) and Mullen et al. (2001) measure the effect of US payments in force for crops, using data on wheat production in Kansas. The results are similar to those of Hennessy. The wealth effect is found to be small, while the insurance effect is larger than the price effect.

Sckokai and Moro (2002) examine the 1992 CAP regime in the framework developed by Hennessy (1998). They apply a dual framework model as developed by Coyle (1992 and 1999). The model is an extended version of the one used in Moro and Sckokai (1999), also incorporating uncertainty. The farmers are assumed to act in accordance with the maximisation of a certainty equivalent utility function. The specification of the utility function depends on assumptions regarding which of the variables are stochastic or not, and assumptions of the structure of the risk preferences. Sckokai and Moro stress the importance of assumptions both on the theoretical and the empirical set-up, as they imply different parametric restrictions. This has also been discussed by e.g. Pope (1988), Pope and Just (1991), Appelbaum and Ullah (1997), and Coyle (1999). The model is applied on Italian data of a specialised arable crop farm from 1993 to 1999. The results regarding the risk related effects show that the relative price and payment effects tend to offset each other. The wealth effect is hence found to be small and thus confirm the results in Hennessy (1998) and Mullen et al. (2001).

In contrast to the studies above is OECD (2004a), which supports the arguments that the risk related effects are highly sensitive to the calibration of the model. The analysis is conducted with the purpose to obtain an estimate of the relative size of the risk related effects in relation to the price effects. An extended version of the PEM crop model (OECD, 2001b) including risk is applied on the PSE database for 1986 to 2001. The analysis builds on the assumption that risk can be studied using farming revenue variability, with no information of costs or other sources of income, and that the aggregate response of farmers can be reflected in a representative farmers risk aversion component. Furthermore, product specific risk premiums are assumed to capture the

risk-related production response of farmers. The analysis reveals that countries with low levels of support have low levels of risk reduction. Moreover, a sensitivity analysis reveals that that the insurance effect is highly sensitive to the value of the relative risk aversion coefficient. The results of the analysis are compared with the results in Hennessy (1998), Mullen et al. (2001) and OECD (2003b). The table below show the share of risk-related effects of US payments in different studies.

	Price effects	Insurance Effects	Wealth Effects
Hennessy (1998)	21%	66%	14%
Mullen et al. (2001)	26%	65%	9%
OECD (2003b) for corn	30%	70%	
OECD (2004a)	66%	33%	1%

Source: OECD (2004a).

Note that the result in OECD (2004a) deviates from the others. In OECD (2004a) the price effect is dominant, while the previous studies have indicated that the risk effects might be important and among them, particularly the insurance effect. In addition to the contradicting result in OECD (2004a), it might be worth to note that Burfisher et al. (2000), in a computable general equilibrium (CGE) model of the US, Canada and Mexico, analyse how direct payments affect output through its effect on risk aversion. The analysis reveals modest estimated production effects through the risk mechanism. Thus, the lack of consensus in the field of the relative magnitude of the risk related effects in comparison to price effects requires further research.

To further complicate the picture, the insurance effect may be offset by a moral hazard effect. Ramaswami (1993) has shown that farmers may cut back the use of risk reducing inputs as fertilisers and pesticides, when the crop is insured. However, results by Wu (1999) presents evidence that the insurance effect dominates the moral hazard effect.

Dynamic effects

In this section, the effect of farmers' intertemporal decisions are examined, i.e. how present consumption-savings decisions will affect tomorrows consumption possibilities. It is also important to note that expectations on future policies have an effect on the investment decision today.

Investment decisions

Phimister (1995) shows in a model of the household's production and consumption, that government payments that would have been decoupled with perfectly capital markets are not when capital markets are imperfect, and the farmer face a debt constraint. The financially constrained farmer potentially uses the income support for investment, or might be regarded as more solvent by creditors, as a consequence of the payment. Roberts (1997) argues that in the absence of perfect capital and information markets, a significant amount of increased farm payments emanating from government payments will be invested. This is also supported by e.g. Rude (2000) who stresses that many producers face debt constraints which thus might be important. Moreover, studies including e.g. Bierlen and Featherstone (1998), Bierlen et al. (1998), Gilchrist and Himmelberg (1995), Whited (1992), Hubbard et al. (1995) have shown that investment is sensitive to cash flow, particularly for firms with debt constraints. Benjamin and Phimister (2002) compare the sensitivity of investment to cash-flow in France and the UK. The findings suggest that the contrasting capital market structures do induce differences in the sensitivity to cash-flow. This implies that constrained capital markets might be a potentially important link between income support and output. Furthermore, the effects through investment might be different in different countries. The farmers in e.g. the new Member States of the EU from Central and Eastern Europe might be more financially constrained than elsewhere in the EU inducing different effects of the CAP in different regions of EU.

It has also been argued that lower income variability can lead to increased household consumption, thus reducing savings and investments. Carriker et al. (1993) have shown that farm households tend to have a higher propensity to consume from secure income sources, such as predictable government payments. Furthermore, expectations of stable transfer payments may increase expected lifetime income leading to increased consumption relative to relative to savings and investment.

Another potential dynamic effect is related to the induced innovation theory formulated by Hayami and Ruttan (1971), where technologies are developed in accordance with price signals to loosen constraints imposed by factor scarcities. This implies that the removal of price support could induce reduced innovation with in the long run would affect the productivity in the agricultural sector.

Expectations on future policies

Income support programs that are directly based on previous production, e.g. output last year, have a built-in dynamic part, since the farmer can directly affect next year's payments with today's production decision. One way of removing the dynamic dimension from the payments, is by using a fixed base year or a base period, on which the payments are based, and not letting the payments be affected by production in the coming years (OECD, 2001a).

However, policies change and farmers expect them to do so, which can affect planting decisions and create a link for support that otherwise would have been decoupled, see e.g. Baffes (2004), Burfisher and Hopkins (2003), and Goodwin and Mishra (2002). For a review of the literature on expectations, see Nerlove and Bessler (2001), who show that expectations can have significant effects on farmers response.

Burfisher and Hopkins (2003) distinguish between farmers' expectations on levels of payment and on expectations on the eligibility of payments. Expectations on the level of payment will affect the wealth level as the price of land reflects anticipated changes in payments. These expectation are then argued to affect primarily the household consumption, saving and work decisions. With perfect labour or capital markets these expectations have no effect on production, but market imperfections may induce such links. Expectations on terms of the payment eligibility, on the other hand, directly affect production decisions. Goodwin and Mishra (2002) report anecdotal evidence that numerous farmers, when asked in a questionnaire, state that they produce crops with expectations on future policy changes including updating of base acreages and yields. Non-traditional crops are not planted with fear of loosing support in the future. Expectations then create a *cross-subsidation effect*, even though no production is required to receive support.

Payments decided on an *ad hoc* basis, such as a disaster relief, can be another potential link, as argued by Young and Westcott (2000). Although decisions of disaster assistance are made ex post, and thus are expected to be decoupled, expectations on such assistance based on past government actions may affect production decisions. Moreover, Young and Westcott refer to Barry (1999), who states that "it is hard not to plan on government assistance when it comes so easily", regarding financial aid to the agricultural sector. A potential moral hazard effect may occur as well as a consequence

of disaster relief. The farmer may be willing to use land, e.g. dry land, that otherwise would not have been used. Thus, the disaster relief may induce new 'disasters' that otherwise would not have occurred.

The public debate on agriculture and its financial support, but also the debate on the natural environment, can potentially affect farmers. The debate can create an image that the farmers believe they must live up to. For example, it has sometimes been argued in the public debate that without support to farmers the landscape scenery would change. An example is the Swedish Society for Nature Conservation (2004), who has commented the reform proposal of the CAP 2003, arguing that regional support is needed for keeping pasture land. This type of actions from e.g. non-government organisations can induce two types of expectations. First, lobbying for e.g. keeping pastureland can affect future policy decisions, as explained by e.g. Becker (1983). Examples of governments that actually have stressed environmental issues in agricultural policies include Sweden and Germany. Second, it could induce a belief founded in an idea that if nothing is delivered, e.g. stewardship of the landscape, the public opinion might become hostile towards agricultural support. This type of arguments can imply that farmers adjust their production even if the support would be decoupled in every other aspect. Consequently, this creates a link between production and support.

Furthermore, in OECD (2001a), *effects from trade* are also briefly discussed. Policies that affect *stock holding* decisions will have a dynamic effect on trade. Policies that affect producers to sell in the future will have an immediate effect on trade, and thus being coupled to trade. Some policies might not be directly coupled to stockholding, but have an indirect effect on stockholding decisions. An example is price support measures that can create expectations on future prices that some stockholder may be willing to benefit from.

Experiences of decoupling in agricultural policies and reforms

Numerous reforms of agricultural support have been made over the years. This section presents some experiences with decoupling of the agricultural policies and reforms with focus on the US and the EU. Furthermore, some famous experiences with one-time buy-

outs is presented, including partial buy-outs in the US and Canada, and the more extensive buy-out in New Zealand where almost all types of support were removed.

The CAP

The CAP of the EU came into force in 1962. The policy was, as formed in the years after the Second World War, constructed to secure the availability of supplies of agricultural products to consumers. The official objectives are to increase agricultural productivity; to ensure a fair standard of living for the agricultural community; to stabilize the markets; to assure the availability of supplies; and to ensure that supplies reach consumers at reasonable prices. Recent reforms emphasised competitiveness, protection of the environment and rural development.

The MacSharry reform of the CAP in 1992 reduced price support for cereals, oilseeds and protein crops, and for beef and veal, and the farmers where compensated with direct payments. The payments for crops where based on historical yields and historical acreage. Set-aside of land where required and area payments where differentiated between types of crops. According to Baffes (2004) the total level of support was unchanged, but its structure was changed considerably. He further argues that, as border protection measures and support based on output declined, the 1992 CAP reform was a good step towards decoupling.

In 1999, the second major reform of the CAP was adapted as part of the Agenda 2000. The reform was a deepening of the MacSharry reform focused at increasing the competitiveness of agricultural products. Price support to crops was further reduced and the direct payments increased and where realigned across crops. The reference year for payments was also changed in some countries. In this reform rural development was also given more importance.

In June 2003, a new reform of the CAP was agreed upon. This reform requires at least 75 percent of payments to be decoupled in the arable sector. The requirement in the beef sector is 60 percent of the slaughter premium for adults and 25 percent of the special male premium. The corresponding figure for the sheep and goat premia is at least 50 percent. *Single farm payments* will be based on average payments claimed over the three-year reference period of 2000-2002 and will be paid per eligible hectare of land. Member states could also opt for a regional model or "hybrid model", where the

reference period may be different. Payment etitlements can be sold with or without land. It is required that farmers meet cross compliance criteria on environmental practices, food safety, and animal welfare. Farmers should also maintain their land in "good agricultural and environmental condition" (European Commission, 2003). More on the CAP can be found in e.g Gardner (1996), Beard and Swinbank (2001) and OECD (2004b).

Empirical examinations of the CAP

The effects of the 1992 MacSharry reform of the CAP and the Agenda 2000 reform have been examined in numerous studies using various methods, including simulations of the effect of the reforms, and ex post econometric studies, but also more qualitative analysis based on institutional changes. In the following section the 1992 reform and the Agenda 2000 reform are discussed based mainly on econometric analyses.

The 1992 MacSharry reform

Oude Lansink and Peerlings (1996) and Guyomard et al. (1996) have contributed methodologically to the analysis of land allocation as a consequence of the 1992 CAP reform. The analyses are founded on models of profit maximisation, where land is a fixed but allocatable factor. This type of model has been used earlier by e.g. Just et al. (1983), Shumway et al. (1984), Chambers and Just (1989), Coyle (1993a, 1993b), Ball et al. (1997), Jensen and Lind (1993), and Moore et al. (1994). The studies by Oude Lansink and Peerlings (1996) and Guyomard et al. (1996) derive land allocation equations explicitly defined from the maximisation of a restricted profit function. Due to lack of data, both studies apply their models to pre-reform data between 1970 and 1992, thus, as acknowledged by the authors, a weakness of both studies are the fact that simulations are based on data from a completely different policy regime.

Oude Lansink and Peerlings (1996) simulate the effects of the 1992 reform with parameters based on panel data for Dutch arable farms. The results show that the 1992 reform of the CAP reduces the output of cereals and oilseeds, but increase the supply of rootvegetable. The effects differ however strongly between farms.

Guyomard et al. (1996) base their simulation on estimates from aggregated French data. Their analysis reveals that the effect on production varies between different crops. The results reveal that the compensatory payments of the 1992 CAP are only partially

decoupled. The authors, however, argue that the impact on supply from the compensatory payments is limited, and "can be considered as broadly neutral, conditional that the total area in grains and oilseeds is fixed". It can thus be concluded from these two analyses of the 1992 MacSharry reform that the reform was not decoupled in the Netherlands and France.

Through the introduction of an index of the degree of decoupling of a policy Cahill (1997) analyses to what extent the MacSharry reform is decoupled by measuring the degree of decoupling for five crops in 12 original member states of the EU. The produced quantity is modelled as being dependent on both planted area and yield. Supply is derived from revenue and profit functions for planted area and yield, respectively. The projected outcome for the reform year 1998/99 is compared to the base year 1991/92. Cahill concludes that the reform payments package is *effectively fully decoupled* from production of wheat, rapeseed and soybeans, while it is *partially decoupled* from production of coarse grains and sunflower. This conclusion, together with the results reported by Guyomard et al. (1996), at least indicates that the MacSharry reform was a step in the right direction towards decoupled agricultural support.

Moro and Sckokai (1999) conducts an ex post study of the 1992 MacSharry reform and a simulation of the Agenda 2000 reform, on data from northern Italy covering the years 1993 to 1995. The theoretical model follows Chambers (1988) and Chambers and Just (1989). A multioutput profit function specification is used to derive land allocation and supply and input demand equations from which elasticities of choice variables are computed. The most important difference between this study and the Guyomard et al. (1996) and Oude Lansink and Peerlings (1996) studies according to the authors, is that their methodology allows them to use post-reform data. The results show that the policy, after the 1992 reform of CAP, does affect crop supply through crop specific aids, set-aside obligations and related payments. Moreover, the results support the view that the reform reduces the use of inputs and the supply surplus. The authors conclude that the MacSharry reform was at best *partially decoupled*.

Sckokai and Moro (2002), described above, analyse the effects of the 1992 CAP reform, and simulate the Agenda 2000 reform in an extended version of the Moro and

Sckokai (1999) model, taking uncertainty into account. The analysis confirms the result obtained in Moro and Sckokai (1999) under the hypothesis of risk neutrality.

The Agenda 2000 reform

The simulation of the Agenda 2000 reform by Moro and Sckokai (1999), and the computation of the degree of decoupling, indicates that land use and production decisions will be affected after the reform, mainly in favour of wheat and against oilseeds. The authors conclude that the policy package of the Agenda 2000 "reform is far from being decoupled".

Gohin and Guyomard (2000) compare the changes in Agenda 2000 with the criteria in URAA. The model follows Guyomard et al. (1996) and is applied to EUROSTAT data on the French sector of cereals, oilseeds and protein crops for 1973 to 1997. The study shows that the CAP after the Agenda 2000 reform is not in accordance with a number of the 'green box'-criteria. However, seen as a package the CAP is found to be more decoupled after the Agenda 2000 than before.

Gullstrand (2003) applies the Moro and Sckokai (1999) model to analyse the effects on Swedish crop-production patterns of the Agenda 2000 reform, using Swedish data between 1997 and 2000. In this study, both an ex post analysis of the Agenda 2000 reform, and simulations of the whole reform is conducted. The impact of the reform is evaluated through the use of elasticities estimated based on a normalised-profit function. The analysis shows that an increase in crop-specific aid and/or set-aside premium increases the supply of land, and land allocated to a particular crop. The results indicate that the Agenda 2000 reform was *not decoupled* from production.

Trends in decoupling of the CAP reforms

The empirical examinations of the reform 1992 and the Agenda 2000 reform provide somewhat mixed results, however, it is clear that the reforms were not decoupled. However, and perhaps more important, the political will in the Agenda 2000 reform seem to be much more directed towards a commitment to decoupling. This is also supported by the findings, by Gohin and Guyomard (2000), that the CAP is more decoupled after the Agenda 2000 reform than before. Baffes (2004) argued that as total support has a downward trend and the EU launched free trade negotiations with Mercosur, the Agenda 2000 propose reforms that include further decoupling.

The positive evolution of the CAP might be partly explained by the negotiations in GATT and WTO and the URAA. Moyer and Josling (2002) and Coleman and Tangermann (1999) argue that the negotiations in the Uruguay Round were a driving force to this reform. Furthermore, it has been argued by Guyomard et al. (2000) that the FAIR Act of 1992 in the US, presented below, put pressure, through the URAA, to further decouple supports in the CAP.

The reform in 2003 of the CAP is a further step towards decoupled support, as the single farm payment (SFP) is introduced. This reform has the potential of further decoupling the CAP, however it is partly dependent on how the member countries choose to implement the reform. A number of countries will implement the SFP from January 1, 2005 based on historical aid receipts (Agra Europe, 2004a). However, differences occur in what will be included in the SFP. While Ireland opt for full decoupling from January 2005 e.g. The Netherlands has opted for full decoupling from 2006 except the slaughter premium that will remain 100 percent coupled. Furthermore, while the dairy premium will remain coupled until 2007. Sweden will implement the SFP from 2005. Beef premiums will only be decoupled at 75 percent and the dairy sector will not be included in the SFP until 2007. Further a national envelop of 0.5 percent to fund marketing and promotion activities will be constructed. Spain considers implementing the SFP, including the dairy payment from January 1, 2006. decoupling rates of 50% for sheep and goats and 100% for the suckler cow premium and 40% for the beef slaughter premium. The UK will decouple all direct aids as of January 1, 2005. However transition programs will be constructed for England, Scotland, Wales and Northern Ireland individually. France will implement the SFP in 2006, however, France will retain partial decoupling for arable payments, ewe premium payments, suckler cow premiums as well as calf and beef slaughter premiums. Germany will fully decouple all CAP payments as of January 1 2005. However, 'complex hybrid system' will be used to allocate the SFP including both historical farm-based payments and flat-rate regionalised payments. This list is not exhaustive but should rather be seen as examples of the exemptions made in some of the member states. Italy and Greece has yet to pronounce officially but both consider 2006 as start dates according to Agra Europe (2004a). OECD (2004b) have analysed the 2003 reform in the AGLINK model (for EU15, i.e. not the new member states) they find, although the modest changes in the

level of support, the reform to be a further step in the direction where a significant part of the expenditures will be less coupled to production and trade, than the CAP under Agenda 2000.

Baffes (2004) argue that the flexibility between coupled vs. decoupled payments, that may occur because of differences between countries, sets up the possibility for farmers to argue for decoupled payments when they see others receiving money without doing anything. This will put pressure on governments to switch to decoupled payments.

However, it should be noted that the degree of decoupling in the 2003 reform could be questioned, partly because of the cross compliance obligations. Furthermore, other policies that affect the agricultural business remain untouched such as support to ecological farming as well as environmental support under the second pillar of the CAP. Such support could affect the farmer's decisions on the margin, depending on the degree of jointness of production of environmental goods and agricultural goods. Jotzo et al. (2003) argue that the reform is a step in the right direction, but they predict that it is likely to only make the agricultural policy slightly less negative for world trade.

Policy reforms in the US

In the *New Deal farm program* in the 1930s the central feature was price support, through a combination of tax financed production subsidies and supply controls with acreage set asides (Baffes, 2004). The total payment was equal to the yield per hectare multiplied by a farm's eligible payment acreage.

The 1985 Food Security Act set a new trend for the major field crop sector by reducing the role of acreage set-asides and public stock holding, which had the purpose to decouple payments from production. Payment was based on average yields between 1981 and 1985.

The Federal Agricultural Improvement and Reform Act (the FAIR Act) 1996 implied that market price support and deficiency payments where replaced with fixed payments based on historical production, which has been called Production Flexibility Contract (PFC) or Agricultural Market Transition Act (AMTA) payments, and with a loan deficiency payment program with the aim to establish minimum support prices for program crops. PFC payments where based on farm benefits received during 1990 and

1995, which in turn was determined on the farmers historical production. The payments were supposed to decline until 2002 and it was implicitly assumed that payments should end at 2002. The FAIR Act was supposed to be a transition toward an environment where the government diminished its role in the markets. However, as prices fell sharply in the 1990s, the government intervened to avoid farm bankruptcies, thus much of what was accomplished in the FAIR Act was reverted (Baffes, 2004). First, emergency payments where introduced, which where approximately equal to 50 percent of the decoupled payments in 1998 and 100 percent of the payments in 1999 to 2001 (Baffes, 2004). Second, as the market price fell below the loan rate, the government issued loan deficiency payments. Third, the 2002 Farm Bill increased several loan rates that allowed for updating base acres and payment yields, and new crops where added to the loan rate scheme.

In the 2002 Farm Bill the PFC payment where replaced with direct payments for crops (DPC) which also are higher than the PFC payments. The DPC will also be constant over 2002-2007 while the PFC, as stated above, were scheduled to decline. The disaster payments that were paid on an ad hoc basis since 1998 are institutionalised in the 2002 Farm Bill in the counter cyclical payments. The farmers are also allowed to update their base acres and yield.

More on US reforms can be found in e.g. Orden et al. (1999), Keeney and Kemp (2002), and Moyer and Josling (2002), and Baffes (2004).

Empirical examinations of agricultural reforms in the US

The FAIR Act

Young and Westcott (2000) examine the impact, of four US agricultural programs in the 1996 FAIR Act, on agricultural production and trade, partly drawing on previous empirical results. The programs discussed include production flexibility contracts, crop and revenue insurance, marketing loans and disaster assistance.

Elasticities estimated by Chavas and Holt (1990) indicates that the PFC payments were expected to increase acreage as well as investment. However, lower prices, as a result of increased production are argued to limit the increase in production. Young and Westcott (2000) conclude that the PFC payments have the least distorting effect of the

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four programs analysed. The payments are argued to have small incentives to increase production, and the mix of planted crops is based on market signals.

Crop insurance subsidies, examined by Young et al. (1999), are estimated to have a small effect on US exports and trade. The analysis is conducted on eight crops for the entire US and in seven major production regions between 1995 and 1998. They report that a large share of producers choose to ignore the subsidy incentive, as participants in the insurance program represented only 61 percent of eligible acres in 1998. Moreover, it is found that not all farmers seek to maximise the income transfer from insurance, but base their insurance and production decisions on a combination of risk management and farm returns objectives.

Effects of the marketing loan program has been analysed by e.g. Westcott and Price (1999), who study the effects on soybean production. They use the USDA 1999 baseline and simulate an econometric model for the US agricultural sector. Reported findings suggest increased soybean acreage due to marketing loans, resulting in higher production and lower prices. Acreage increases reduce acreage of other crops, primarily corn, sorghum and cotton, thus implying cross crop effects. Most impacts are found to occur in years when there are soybean marketing loan benefits, i.e. when prices are lower than the loan rate. As a result of the acreage effects, exports of soybean oil were found to increase by 1-2 percent, cotton exports declined with 1-2 percent. At the same time the effect on exports of corn and sorghum was smaller, and it declined by less than 1 percent.

Young and Westcott (2000) further discuss the effect of disaster assistance. It is argued that, as discussed above, the only possible link between this support and output goes through expectations. Further, it is argued that the magnitude of this support probably is smaller than the effect of marketing loans. However, no empirical results are presented to support this view.

Young and Westcott (2000) conclude that despite the single programs increase production and trade, the net impact of the four support programs tends to be small. However, exports remain marginally higher as a consequence of these programs. Further, it is argued that the PFC program has the smallest effect on production.

Goodwin and Mishra (2002) analyse to what extent the US farm program benefits are decoupled, or bring about distortions in production. The study focuses on the effects

of PFC and market loan assistance payments on land allocation of corn, soybeans and wheat at mainstream commercial farms in the Corn Belt region in the US between 1998 and 2001. They report that these payments seem to have a limited effect on production and trade, thus supporting the conclusion reached by Young and Westcott (2000). Further, they report that the effect of PFC payments is smaller than the effect of market loan payments. The results found by Goodwin and Mishra reveal that PFC payments are nearly production-neutral. Although the payments have statistically significant effects on acreage on all crops the effects are claimed to be modest and the elasticities are in the interval 0.02 – 0.03. Goodwin and Mishra argue that the result is not surprising since the PFC payments averaged 1.8 percent of the typical farms payment. However, the estimated acreage elasticity from market loan assistance payments is 0.12, thus indicating that these payments have a stronger distortionary effect.

The PFC payments have also been analysed by Burfisher and Hopkins (2003). The study synthesizes three different analytical approaches. First, the household allocation of income and PFC payments is described, and an analysis of the recipients' financial situation is conducted, including land ownership and rental, consumption, saving, investment, on-farm and off-farm labour. Second, cross-section data is used to empirically estimate the impact of PFC payments on farm households' on- and off-farm labour supply and leisure hours. Third, the impact on agricultural production from PFC payments is simulated in a CGE model. The study is based on Agricultural Resource Management Survey (ARMS) data from 1996 to 2002. The findings suggest that the participating households exercise considerable choice in the allocation of their savings across their investment portfolios. The PFC payments do not change the level or variability of market returns and therefore provide no incentives for additional farm investment. Further, the payments have increased the level of overall well-being of households. They have also resulted in small reductions in households' work hours. The simulation of US payments program indicates that the links to farm production levels are minimal. Burfisher and Hopkins (2003) thus support the findings that PFC payments have limited effects on production, and further add that the payments where efficient in transferring income.

The 2002 Farm Act

Baffes and de Gorter (2003) and Baffes (2004) argue that the increased loan rates, the updates of base acres and payment yields together with the introduction of counter-cyclical payments imply that the 2002 Farm Act is less decoupled than the 1996 FAIR Act. This conclusion is further supported by OECD (2003b), where the effects of the reform is analysed through simulations in the AGLINK model developed by the OECD. They conclude: "Although the impacts of the 2002 Farm Act simulated in this section are small, the new farm act risks accentuating production distortions and trade tensions and is not in line with the long-term OECD reform objective."

Trends in the US refoms

Compared to the EU, the efforts to further decouple the US agricultural policy seem to have halted. While the FAIR Act 1996 that has been argued to put pressure on the reform work on CAP as proposed 2003, implied increased decoupling of supports, the 2002 Farm Act have been argued, by e.g. Baffes (2004) to be less decoupled than in 1996. Thus, the while the EU is moving towards more decoupled payments the recent developments in the US indicate that such a movement have been halted.

Turkey

In 2001 Turkey started an agricultural policy reform with World Bank Assistance. The agricultural reform is part of a reform program for the whole economy, induced by the financial crisis in November 1999. The World Bank will assist Turkey with a rescue loan designed to restructure the financial sector, and this loan is conditioned on the reforms.

The agricultural sector is important in Turkey and has been heavily supported by the government. 40 percent of the labour force is employed in agriculture, and support to this sector as a share of GDP is 5.1 percent, which is the highest among OECD countries (Baffes, 2004). Add to this that the GDP per capita in Turkey is slightly above 3000 USD, which further points at the burden of agricultural support on the budget. The support to the agricultural sector has been in the form of boarder measures, price support, input subsidies and budgetary payments.

The purpose of the reform in 2002 was to reduce artificial incentives, input subsidies and the government's role in marketing agricultural products (USDA, 2001).

The main elements of the reform are replacement of price support and input subsidies by direct income support payments. This will also include one-time payments to farmers who move away from overproduced crops. Furthermore, the loan conditions require that tariffs will be gradually reduced.

Baffes (2004) reports a number of problems connected to the reform work. A pilot program was carried out in four provinces in April and September 2000. The program exhibited problems both with unclear land registration and ownership but also with the design and implementation. Information was insufficient, and as a consequence, many farmers failed to supply to the program.

The PROCAMPO Reform in Mexico

In 1994 the Mexican government introduced a decoupled support program, Programa Nacional de Modernizacion del Campo (PROCAMPO) aiming at supporting incomes of grain and oilseed producers. A description of the program can be found in e.g. Sadoulet et al. (2001) or Baffes (2004). The program replaced an old scheme of guaranteed prices. Payments are received on a per hectare basis, calculated on land used for nine basic crops in one of the agricultural years before August 1993. Initially the program decoupled payments from land use, but this were later changed by requiring that the land continue to be allocated to eligible crops. This change of rules has, according to Baffes (2004) reduced government credibility. Furthermore, a potential expectations link exists in the PROCAMPO program. As the program was announced in advance it became possible for farmers to increase their production of eligible crops, thus increasing their future payments. Moreover, in 2002 the price support was reintroduced in form of counter cyclical payments, further reducing the initial decoupling effect.

The purpose of the program, besides reducing production and trade distortions was to improve income distribution. Relatively higher income support to poorer farms is achieved through the imposition of a ceiling at 100 hectares on the amount of land that gives right to receive support. Besides, the support increases with the distance of the farm to the market. This part of the reform has been successful according to e.g. Baffes (2004).

Sadoulet et al. (2001) have analysed the effects of increased income between 1994 and 1997 as a result of the reforms. They found that the programme created a substantial

indirect effect through multiplication of the liquidity received. Consequently, the support has a positive effect on the household's possibilities to invest in human and physical capital. Thus, both this link and the expectations link can induce a link between payments and output in the program. However, Burfisher et al. (2000) have compared the effects from direct payments on output in Mexico, the US and Canada. They find the effect in Mexico to be surprisingly small compared to the US. The overall finding suggests that the effect on output is small.

To conclude, the empirical findings suggest that the Mexican PROCAMPO reform has succeeded in raising income, without creating to a large effect on output and trade.

Sweden

Sweden reformed the agricultural support system in the beginning of the 1990s. This reform was not a decoupling reform in a strict sense, but it was certainly a step towards a more deregulated agricultural market. The reform included internal deregulation of agricultural markets in combination with set aside of land. Out of a total of 2.9 million hectares of arable land 500.000 hectares where intended to be se aside. The set aside was made on a freely basis and the farmer was compensated. According to Statistics Sweden, the outcome was that 350.000 hectares were set aside. Which in relation to total eligible land is a remarkably high percentage. It should also be noted that the policy was shifted again towards a more subsidised agricultural sector when Sweden joined the EU in 1995, and thus the set aside reform expired. However, it might be interesting to note that the arable land moved back into farming only amounted 260.000 hectares indicating a permanent reversion of 91.0000 hectares as a result of the reform. The impacts of the Swedish reform remain to be further analysed, a sub project within the IDEMA aims at contributing to this.

Experiences with one-time buyouts

As a decoupled policy should have no, or limited, effect on output, a policy that includes a removal of all support would certainly be decoupled, as argued by Spriggs and Sigurdson (1988). In the last two decades, subsidies have been eliminated in numerous one-time buyouts. Often these reforms are targeted at one specific area, such

as the peanut quota buyout in the US in 2002, the Canadian Crow Rate transportation buyout in 1995 or the grape wine buyout in the EU. However, an overall one-time buyout occurred 1984 in New Zealand. This type of reform has been regarded more successful in a decoupling perspective than the more broad attempts described above (Baffes, 2004).

In 2002 the US government bought out the peanut quotas, that where introduced in 1978. The quota holders will be compensated with annual payments in the period of 2002 to 2006. However, as noted by Baffes (2004), this can not be seen as a pure one-time buyout as the farmers now have access to the other provisions in the 2002 Farm Bill, in form of decoupled and counter cyclical payments. Baffes (2004) argue that the three important drivers for this reform were: first, the cost of the program increased enormously; second, that the peanut manufacturers lobbied for reforms to get access to cheaper peanuts; and third, that peanuts were included in the NAFTA agreement, thus being trade freely between the US and Canada and Mexico.

In 1897, the Canadian railway project between Alberta and British Columbia was subsidised. In return the railway company agreed to reduce the transport charges for the grain farmers with 20 percent. In 1995, the Canadian government bought out this subsidy with a one-time payment to farmers combined with investments in a more efficient grain handling and transport system. Baffes (2004) describes the outcome of the buyout as good, with lower grain prices that stimulating the value added industries, and higher transportation costs inducing diversification in agriculture.

The most radical buyout reform was carried through in New Zealand in 1984. Forced by severe macroeconomic problems, the government deregulated the economy in a wide range of fields, which included elimination of nearly all types of subsidies in the agricultural sector. In return farmers were offered an *exit grant* if leaving the agricultural sector.

The agricultural business in New Zealand was one of the most subsidised in the world before the reforms. Before 1984 about 40 percent of sheep and beef farm income came from government payments, (Bell and Elliott, 1993). The farmers received so much support that overseas competitors argued for taking actions against New Zealand exports (Lambie, 2001).

The transition was assisted by the government through offering the farmers who decided to exit the agricultural sector an exit grant of about 2/3 of annual income, and temporary assistant measures were introduced. The government did only limited efforts to soften the effect of change as argued by e.g. World Bank (2003) and Baffes (2004). At the time of the reform about 10 percent of the farmers were expected to exit the agricultural sector, however only 1 percent did exit. The losers of the reforms were those farmers who had started just before the reform and those with heavy investments in land (Johnson, 2001).

The reforms have been regarded successful, and e.g. the World Bank (2003) reports that since 1986-87 the agricultural sector has grown by over 40 percent in constant terms, and the contribution to the economy has risen by 14.2 percent of GDP in 1986-87 to 16.6 percent in 1999-2000. Furthermore average productivity growth has risen from 1.8 percent between 1972 to 1984 to 4 percent between 1985 to 1989 (Lambie, 2001). There are however, different opinions on the sources of productivity growth. As referred by the World Bank (2003), Morrison et al. (2000) have questioned the positive effects on productivity while Kalaitzandonakes and Bredahl (1994) has confirmed such positive effects following the reforms.

To conclude, the buyout reform in New Zealand has proven to be a successful in the years after the transition period. Thus, lessons from this example would be interesting for reform work elsewhere. Johnson (2001) exemplifies this with the conclusion that a more coordinated sequencing of the reforms would have benefited the agricultural sector. The most important lesson however, is that the reform proofs that the agricultural sector can be successful in a deregulated economic environment. The World Bank (2003) conclude that "Overall, the removal of support did not have a grave effect on New Zealand's farmers. Instead, the policy of liberalization created a more vibrant, diversified, and sustainable rural economy in New Zealand."

Concluding discussion

This paper examines the concept of decoupling and exemplifies with some practical experiences by reviewing past research. Attempts to reform agricultural policy with the

purpose to decouple support to agriculture have followed the GATT and WTO negotiations and the later agreement, the URAA, in 1993.

The URAA attempts to limit trade-distorting support, and provides the 'legal' definition of decoupled support, which is based on the fulfilment of five criteria. This definition has been criticised, since there is no guarantee that a policy classified as decoupled, based on the URAA criteria, will not affect output, which is the ultimate purpose of decoupling. In contrast to this, Cahill defines policies as being decoupled based on the outcome of the policy. In Cahill's definition, a policy is defined as being decoupled if it ex post is shown to have no or limited effect on output, i.e. level of production. Further, Cahill argues that policies should not be evaluated on an individual basis, but rather in a 'package' along with coexisting policies.

A number of potential links between different types of support to agriculture and output have been identified in the literature. Support that affect incentive prices give raise to what is known as the *price effect*, and the *cross-subsidation effect*. The cross-subsidation effect appears as a result of changes in prices of commodities that are substitutes in production or input use. As a consequence the allocation of land and other input use may be affected which in turn affects output. In an attempt to decouple the agricultural policy these effects can be removed by e.g. providing support through lump-sum transfers. However, indirect effects may remain after the reform, as agricultural support may induce indirect effects by the pure existence of the support. These include the *income effect,* where the support potentially affects the farmers' choice of on-farm labour supply. Further, a *risk related effect* arises as risk averse producers may increase output as a consequence of an income support. Finally, *dynamic effects* may affect output through investment decisions and expectations affected by the policy. The review of the empirical examinations of the above mentioned effects shows that the direct effects on output of support to the agricultural sector are important. Studies of indirect effects are up to this date, fewer and with less consensus. The risk related effects were in early studies found to be potentially more important than the price effect, in creating links between support and output. A recent study (OECD, 2004a), however, point in the direction that the price effect is more important than the risk related effects.

The practical experiences with decoupling of agricultural support have been mixed. While the one-time buyout in New Zealand in 1984 has lead to a deregulated and internationally competitive agricultural sector, the MacSharry and the Agenda 2000 reforms of the CAP have been found not to be decoupled according to empirical examinations, although the Agenda 2000 reform revealed a political commitment to further decouple agricultural support. In the US, the FAIR Act in 1996 reduced the distortions on output, but the 2002 Farm Bill has been concluded to be less decoupled than the FAIR Act. The drivers behind the reforms have, however, not primarily been to achieve decoupled support. Tight domestic financial situations have been referred as being an important factor behind the above mentioned reforms, as well as for the reforms in Turkey and for the 2003 reform of the CAP. Despite the primary reason for reforming the policy, the reforms are important, as generally being steps in the direction towards an agricultural sector without production and trade distorting subsidies, albeit exceptions exist.

Critique on the URAA criteria based definition of a decoupled policy raise the question whether this agreement is an effective tool in the work to mitigate the distortions on output and trade from agricultural income support. Tangermann (2003) have found that while the level of support has not changed significantly since the agreement, a decline was found to take place during the URAA negotiations. Moreover, the general pattern of the support have changed from the most distorting measures, such as price support and output subsidies, to less distorting measures as area payments and payments based on fixed entitlements. This is an indication that the URAA negotiations and the URAA have been important for the reforms of agricultural policies. Furthermore, free trade aspects have been more important in the policy formation debate than before according to Tangermann.

The negotiations and the URAA can be seen to create links between policies in different countries, thus inducing a harmonisation of the effects on output. It has, for example, been argued that the FAIR Act put pressure on the EU to reform the CAP, in order to be further decoupled than the prevailing policy and thus fulfil the URAA. The 2003 CAP reform can be argued to be more decoupled based on the URAA criteria. However, it remains to be examined whether the reform will pass an ex post analysis.

It might however be noted that the construction of the URAA also may leave room for reforms towards a more coupled policy. A state with a liberal agricultural policy in relation to what is allowed in the agreement, may reform their policy such that support to the agricultural sector are increased up to the maximum levels in the URAA. The US agricultural policy in the 2002 Farm Bill, which has been found to be less decoupled than the FAIR Act of 1996, may be an example of this.

The experience from New Zealand with the one-time buyout is interesting from the point of view of reducing support to agriculture. This radical reform with removal of almost all types of support to the agricultural sector, have proven that an agricultural sector can be competitive in the international market without being protected.

The review of previous research has revealed the need for further research both on the effects of agricultural support on production, and the effect on domestic policy formation of the existence of the URAA. The magnitude of the risk related effects need to be further explored, and the potential dynamic effects are the least explored. It should however be noted that the OECD have ongoing programs on both the dynamic and the risk related effects. The importance of factor market imperfections is another area where further insights would be beneficial. Another idea for further research is the impacts of structural change on production and productivity in the context of policy reforms This type of analysis have not been found in the decoupling literature. Finally, as it has been argued that both the negotiations on, and the existence of the URAA affect the national policy debate, such links may be an interesting subject for further analysis.

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