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GTAP Annual Conference on Global Economic Analysis
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How Decoupled is the SFP in GTAP: Using a Sensitivity Analysis to Uncover the Degree of Coupling

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Paper prepared for presentation at the 15th Annual Conference on Global Economic Analysis
Change and Uncertainty
"New Challenges for Global Trade and Sustainable Development"
June 27 to 29, 2012
Geneva, Switzerland

1 Introduction

Since 1992 the Common Agricultural Policy (CAP) of the EU has been subjected to various reforms. The implementation of the Single Farm Payment (SFP) and its corresponding concept of decoupling support from production in 2003 was clearly one of the most important ones. However, a strong debate about the degree of decoupling of SFPs is still going on today.

The most recent concluded WTO classification of domestic support payments was implemented in the Uruguay Round Agreement. They comprise reduction commitments on blue and amber box support. Only the domestic support payments allocated to the green box are regarded as no or only minimally trade distorting and are therefore exempted from reduction requirements. These reduction requirements are further discussed and tightened in the still ongoing Doha Round. To be able to fulfill these reduction criteria the EU put much effort in reforms of the EU CAP. With the introduction of the SFP the EU developed a decoupled payment given to farmers which should have no effects on agricultural production. Due to the implementation of the SFP the EU was able to shift most of their blue box payments to the green box and thereby meet possibly more restrictive future bindings. However, politicians and researchers assume that those payments still have negative impacts. Even if the payments are decoupled from production, they can create incentives to produce. The SFP may not directly lead to an increase in production, but may influence farmer's decision about farm exit, about off-farm labor or at least has an effect on risk which influences the readiness to accept risk of farmers and stay in business.

It is of importance to take SFP as correct as possible into account when analyzing WTO negotiations. The GTAP model is often used for this purpose. Therefore it is essential to update the GTAP data base and model according to the actual policy changes and try to rebuild their effects as close as possible to reality and/or be aware of effects, if underlying assumptions are not correctly implemented. In this paper we focus on the implementation of domestic support payments in the GTAP data base and the corresponding modeling of SFP in the GTAP model.

We start with a literature overview to get insights in how decoupled payments are modeled and what problems may arise when they are implemented in CGE models. Given this background we thereafter assess how sensitive simulation results are with regard to the mode utilized to model the SFP. Starting point of our analysis is the revised implementation of domes-

tic support in version 8 of the Global Trade Analysis Project (GTAP) data base. Here, our focus is on EU agricultural domestic support and particularly on the SFP.

2 Literature review: Decoupling

To fulfill future WTO commitments the EU had to reform the CAP. One of the most important aims of the WTO is the reduction of domestic support payments to agricultural producers. Only domestic support allocated to the category of green box payments is tolerated by the WTO members. Therefore, the EU seeks to modify the CAP and newly introduced the SFP in the Mid-Term Review (MTR) in 2003. Domestic support payments, e.g., the SFP allocated to the green box payments are considered to be decoupled and to have no effect on production.

How is decoupling defined? Cahill (1997) clarifies the term decoupling in his literature overview which also constitutes the basis for the OECD's conceptional overview of decoupling (OECD, 2001). He distinguished between 3 stages of decoupling in his formal concept:

(1) Full decoupling is the most restrictive definition and refers to a policy that does not influence production decisions of farmers receiving payments.
(2) Effective full decoupling states that a subsidy can be declared as decoupled, if the production does not differ from the production level that would have occurred in the absence of that policy measure.
(3) Partial decoupling corresponds to the provision of a subsidy which results in production that for any product exceeds the level that would exist without compensation, but does not achieve the level that would exist if the payments were fully coupled.

Accordingly, decoupling can be considered to be a very complex topic. How can we know if payments are fully decoupled or if there is still a link to production? The definitions above show the necessity for a formalization of the degree of decoupling. However, it is not clear yet, how the degree of decoupling can be measured. Are there any other potential channels of coupling, e.g., through labor, land, risk or wealth effects which could have an impact on agricultural production? Several papers identify approaches how to model decoupled payments taking different channels of decoupling into account. Here, coupling mechanisms are taken into account which arises due to different allocative effects of payments. These are mainly uncertainty, imperfect credit, land and labor markets as well as farmer's expectations about future payments (BHASKAR and BEGHIN, 2009).

Reviewing the literature with regard to different coupling channels it seems that most authors are only able to consider one or two of the different channels in their analysis. This review is

therefore not intended to give a complete overview of different coupling channels. It rather provides an overview about different coupling channels and how researchers measure their influence. More details are provided in the Table A1 in the Appendix

Decoupled payments increase farm income and reduce the income variability. This leads to the so called insurance effect (BHASKAR and BEGHIN, 2008). Most of the papers considering this issue are dealing with the effect of decoupling on risk and uncertainty. HENNESSY (1998) measures the effects on risk aversion using utility functions with constant and decreasing absolute risk aversion. According to HENNESSY'S ANALYSIS counter-cyclical payments (CCP) create risk-related incentives to produce. ANTÓN AND MOUEL (2004) apply and further elaborate the method developed by HENNESSY. HERE, the same level of price truncation CCPs program has ceteris paribus weaker risk-related production incentive effects than the loan deficiency program. This result is reversed when the quantity produced is low relative to the base quantity. Based on this approach JUST (2011) develops a new calibration technique to quantify the minimum change in concavity of the utility of wealth function which is required to show the change in production behavior for some discrete change in wealth. His analysis however shows that the size of the wealth transfer to induce substantial changes in risk aversion must be extremely high to create remarkable differences.

Beside the reduction of income variability decoupled payments lead under decreasing absolute risk aversion preference to smaller coefficients of absolute risk aversion, which BHASKAR and BEGHIN (2008) denote as the wealth effect. The measurement of coupling effects through wealth for risk-averse farm households is considered by FEMENIA et al. (2010). Using a similar approach, they reveal that even without taking capitalization into account an underestimation of coupling effects is given, because the corresponding programs affect farmer's attitudes towards risk.

Beyond, decoupled payments can influence the farmers' investment or credit decisions. Decoupled payments lead to an increase in farm income and allow for higher savings and investment. Furthermore, decoupled payments increase the farmers' liquidity and thereby improve access to credits. In their analysis SCKOKAI and MORO (2009) approve that the degree of uncertainty regarding expected profit is the key to determine the rate of investment. LOBLEY et al. (2010) emphasize that market signals may become a more powerful driver of farmers' behavior than CAP instruments. They also find that only a minority of farmers seems to be able to exploit related opportunities. Similar results are presented by CHAU and DE GORTER (2005) GOODWIN and MISHRA (2006) and LATRUFFE et al. (2010).

Additionally, decoupled payments may have an influence on off-farm and on-farm labor supply. SERRA et al. (2005) analyze whether 1996 US farm policy reforms altered labor-supply decisions using a probit model. According to their analysis decoupled payments have a negative impact on off-farm work participation and diversification of household income sources. PETRICK and ZIER (2011) focus in their analysis on the employment effects of the entire portfolio of CAP measures. They find significant reduction in agricultural employment, holding other influences constant, and pointed out that an increase in direct area payments on average leads to labor shedding. Contrary, KEY and ROBERTS (2009) mentioned nonpecuniary benefits from farming which may lead to increase in on-farm work. On-farm work is as well heightened by decoupled payments, because they increase farmers' income and liquidity, and reduces the dependence on off-farm work.

Decoupled payments are paid per acre which results in higher land rents and land values affecting exit decisions of farmers. Land remains in agriculture and thereby influences agricultural output. Many authors confirm the capitalization of land values and the effect on production output. However, VAN MEIJL ET AL. (2006) state small negative effects on land use and effects smaller than in case of market price support for the production impacts. Moreover, JUST and KROPP (2009) analyze the effects of decoupled payments over time. They state that direct payments may be decoupled in a static analysis, but can become coupled in the long run.

This literature overview indicates the complexity of decoupled payments. Particularly, SFP are difficult to analyze when different coupling channels are taken into account. Most authors conclude that there are incentives to increase production induced by decoupled payments. However, they also state that those effects are rather modest. The effects of decoupled payments on land allocation and related production effects are the highest. Furthermore, this review shows that there is any paper which takes all coupling channels into account. Hence, when analyzing decoupled payments it might be necessary to neglect coupling channels which are not of prior importance for the analysis, but be aware that this might lead to slightly distorted results. The literature review also indicates that it might be adventurous to substitute assumptions on decoupling by econometrically estimated coupling factors.

Figure 1 summarizes the coupling mechanism found in the literature review. Given the magnitude of these effects it seems reasonable to prioritize their implementation in our analysis that is based on the GTAP model. Starting point is therefore the accurate representation of SFP in the GTAP data base which utilized the OECD PSE data base. At present the total SFP

payments are distributed according to factor shares and allocated across sectors using a homogeneous rate for each factor.[1] This detailed representation of the SFP payment in the GTAP data base and an appropriate extension of the GTAP model enable us to separate the effects of decoupled payments on production as well as on labor and land allocation. [2]

Figure 1: Coupling channels and possibilities to represent them within the GTAP framework

Coupling Mechanism / Degree of decoupling	Production	Risk	Credit constraints	Labor allocation	Land markets	Farmers expectations	Wealth	other
Coupled	GTAP	?	?	GTAP	GTAP	?	?	?
Partial decoupled	GTAP	?	?	GTAP	GTAP	?	?	?
Fully decoupled	GTAP	?	?	GTAP	GTAP	?	?	?
Effective fully decoupled	GTAP	?	?	GTAP	GTAP	?	?	?

Source: Own graph, 2011

To analyze the effects of the other channels, e.g., credit constraints, farmers' expectations, wealth or risk the GTAP model has to be further extended. However, suitable coupling factors are not available yet.[3] Their estimation is beyond this analysis and considered to be future work. Instead we are applying a sensitivity analysis where we assume different degrees and modes of coupling to analyze the effects on simulation results.

3 Domestic support in the extended GTAP framework

The analysis in this paper is based on the GTAP version 8 data base. This data base is composed of individual country input-output data bases which accounts for inter-sectoral linkages within regions. Furthermore the data base comprises bilateral trade, transport and protection data, and economic linkages among 114 regions and 57 commodities for the year 2007.[4]

Starting point of our analysis is the implementation of domestic support in version 8 of the GTAP data base. We focus on EU agricultural domestic support and particularly on the SFP. Accordingly, we consider the EU at member state level and the agricultural commodities as disaggregated as possible.

1 More details on this procedure are given in Chapter 4.
2 For more information refer to Chapter 3.
3 SCKOKAI and ANTÓN (2005) develop an approach to estimate the degree of decoupling of the 1992 area payments for arable crops in the EU including risk-related effects. However, the authors conclude that the results cannot be used to estimate the degree of decoupling of the SFP.
4 More detailed information can be found on the GTAP website at: (www.gtap.agecon.purdue.edu.databases/default.asp).

The revised agricultural domestic support of version 8 of the GTAP data base originates from the OECD's producer support estimate (PSE) tables of the year 2007 for the EU27. The PSE concept contains market price support and budgetary transfers. Since market price support also includes border measures, it is not included in the GTAP data base to avoid double counting with other policy measure, e.g., tariffs. Only the budgetary transfers are finally implemented in the GTAP data base.[5] PSE categories of support are specified into four groups of support given to primary agricultural production (OECD, 2010, pp. 17/18).

- **activity-specific payments / single commodity transfer (SCT):** Payments given to specific primary agricultural commodities, arising from policies linked to the production of a single commodity such that the producer must produce the commodity in order to receive the transfer.
- **group-specific payments / group commodity transfer (GCT):** Payments given to a group of primary agricultural commodities, arising from policies whose payments are made on the basis that one or more of a designated list of commodities is produced, e.g., a producer may produce from a set of allowable commodities and receive a transfer that does not vary with respect to this decision.
- **activity-generic payments / all commodity transfer (ACT):** Payments given to all primary agricultural commodities, arising from policies that place no restrictions on the commodity produced but require the recipient to produce some commodity of their choice.
- **other transfer to producers (OTP):** Payments given to all primary agricultural commodities as a homogenous rate of support to land, capital and labor, arising from policies that do not require any commodity production at all (OECD, 2010).

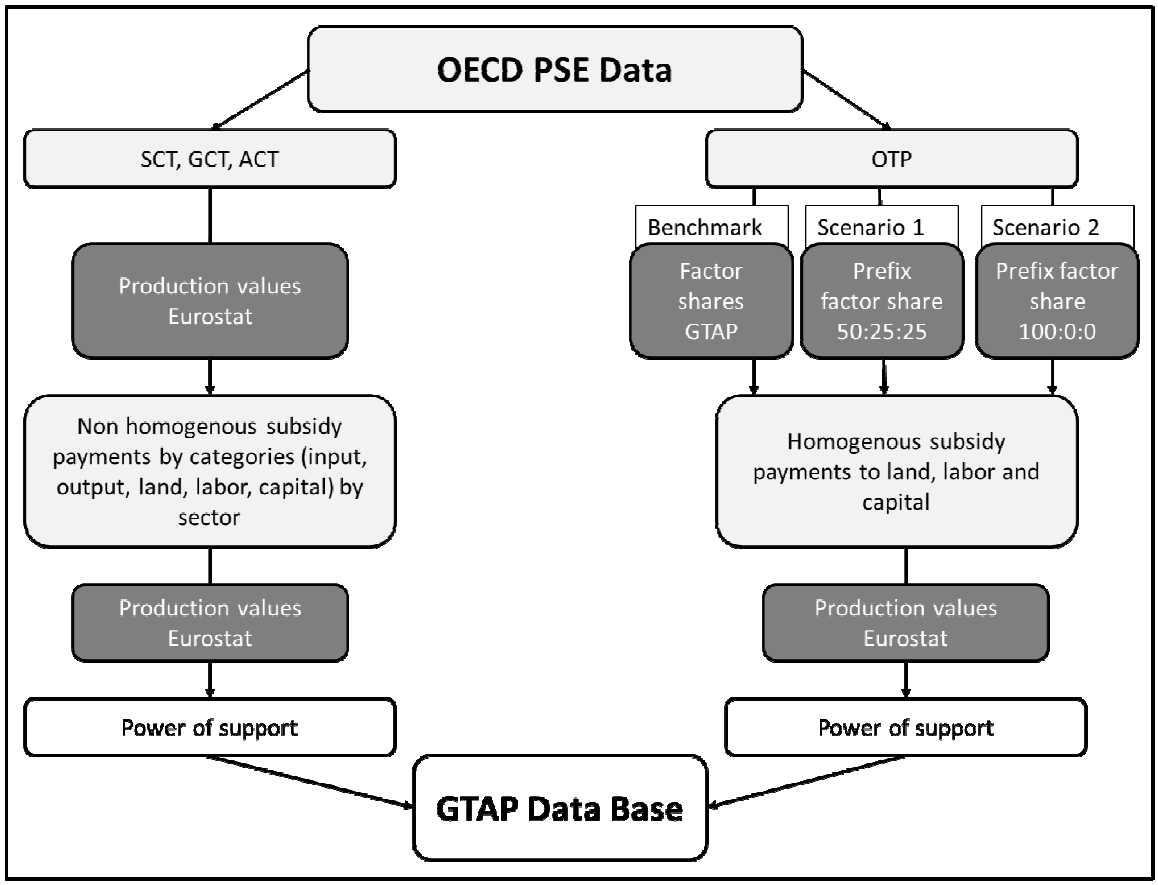
The PSE data of the OECD is only available for the EU27 as a whole. Consequently, we had to divide this data to create individual PSE tables for all 27 member states. In so doing, additional information provided by the OECD, the Financial Plan of the EU Commission as well as the EAGGF Guarantee Fonds is employed.

The first three types of payments (SCT, GCT and ACT) have to be allocated according to the categories of support (input, output, land, labor and capital) and the 12 primary agricultural sectors as represented by the GTAP data base. This can easily be done for the SCT payments, because they are clearly related to sectors and categories. For the other types of payment however, an allocation mechanism is required. The ACT and GCT payments are firstly distributed to the different category of payments. Thereafter the payments of each category are allocated to the agricultural sectors relative to each sector's share in the total value of production of each member country as given by Eurostat. This leads to subsidy payments to input,

5 More information about the PSE concept and the classification of budgetary transfer is available at the website www.oecd.org and in the PSE manual (OECD, 2010).

output, land, labor and capital for 12 primary agricultural sectors as represented by the GTAP data base (compare Figure 2).

Figure 2: Transferring OECD domestic support to the GTAP data base



Source: Own graph, 2011.

The OECD PSE classification of support named OTP reflects the CAP's decoupled SFP and is particularly important in our representation of domestic support in the GTAP data base. Therefore, the focus in our paper is on the allocation of this particular type of support. By how much does the mode of allocation of SFP payments create an incentive to produce? To get more insights, we conduct a sensitivity analysis and distribute the SFP across factors using three different approaches (compare Figure 2).

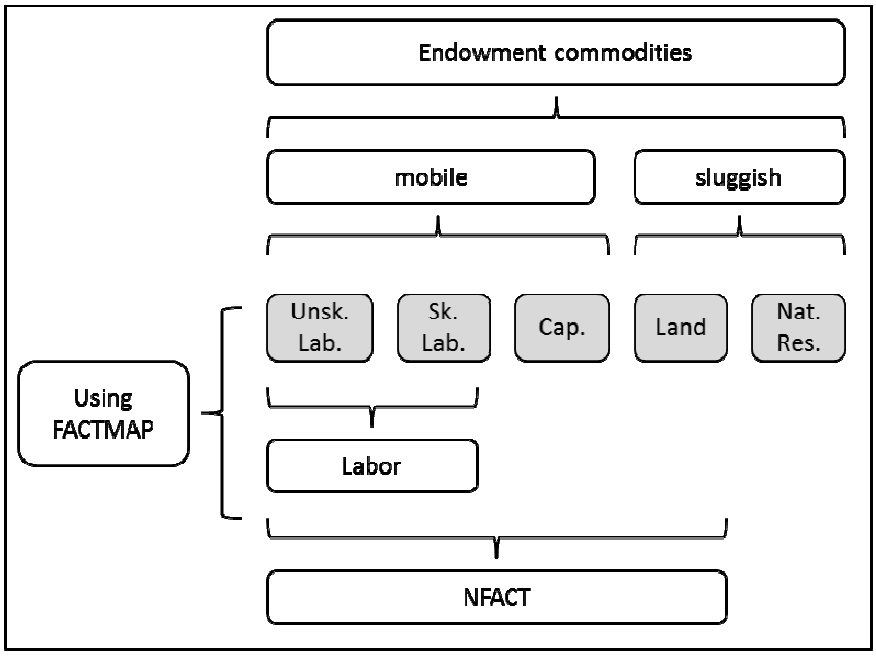
The first one is allocating the OTP payments of the OECD according to the factor usage in each sector. In so doing, we require additional information on factor shares in each of the agricultural sector. This information comes from the GTAP data base where we first map the factors according to Figure 3.

Thereafter, we are able to calculate the factor usage share ($TVFMSHR_{ir}$) as sum of firms' purchases at market prices for land, labor and capital in all agricultural sectors ($TVFM_{ijr}$) divided by the sum $TVFM_{ijr}$ over land, labor and capital.

$$(4.1)\quad TVFMSHR_{ir} = \frac{\sum_{j \in AGRI} TVFM_{ijr}}{\sum_{i \in NFACT} \sum_{j \in AGRI} TVFM_{ijr}} \qquad \forall i \in NFACT \quad \forall r \in REG$$

with	$TVFMSHR_{ir}$	Factor usage share
	$TVFM_{ijr}$	Factor usage
	AGRI	Agricultural commodities in the GTAP data base
	REG	EU 27 countries
	NFACT	Endowment land, labor, capital

Figure 3: Factor mapping



Source: Own graph, 2011.

This factor share is then multiplied with the OTP which leads to other transfer payments allocated according to the factor usage ($OTRAN_{ir}$).

$$(4.2)\quad OTRAN_{ir} = TVFMSHR_{ir} \cdot OTP \qquad \forall i \in NFACT \quad \forall r \in REG$$

with	*OTP*	Other transfer payments to producers
	$OTRAN_{ir}$	Other transfer to producers by factor usage

In the second and third approach we used a prefix share to distribute the OTP. On the one hand the OTP is allocated according to a share of 50% on land, and 25% on labor and capital,

respectively. On the other hand we increased the share of land to 100%, whereas none is given to labor and capital. Each of these approaches to allocate the OTP leads to subsidy payments to land, labor and capital.[6]

So far we only manipulated the OECD PSE data of support with additional information from Eurostat and the GTAP data base. To finally get them into the GTAP data base, we calculate power of support for each category. This is done by putting subsidy payments resulting from SCT, GCT and ACT (Equation (4.3)) and from OTP (Equation (4.4)) in relation to the production values of Eurostat (compare also Figure 2).

$$NH\_POS_{ijr} = \frac{NONOTPSUB_{ijr}}{PRODN_{jr}} \qquad \forall i \in CATEG,\ \forall j \in AGRI,\ \forall r \in REG \tag{4.3}$$

$$H\_POS_{ir} = \frac{OTRAN_{ir}}{\sum_{j \in AGRI} PRODN_{jr}} \qquad \forall i \in NFACT,\ \forall r \in REG \tag{4.4}$$

with	NH_POS_{ijr}	Power of support from SCT, GCT and ACT by endowment and sector
	$NONOTPSUB_{ijr}$	Subsidy payments resulting from SCT, GCT and ACT
	$H\_POS_{land\ r}$	Power of support from OTP by factor
	CATEG	Categories input, output, land, labor and capital

These powers of support are utilized to recalculate the values for the GTAP data base employing a specifically tailored Altertax procedure. It is obvious from Equation (4.3) that subsidy payments resulting from SCT, GCT and ACT are distributed with a non-homogenous rate across agricultural sectors. In contrast, the subsidy payments resulting from OTP are distributed across sectors using a homogenous rate. This is done by dividing the difference between producer expenditure on agent's prices and producer expenditure on market prices to homogenous and non-homogenous support categories (compare Figure 4).

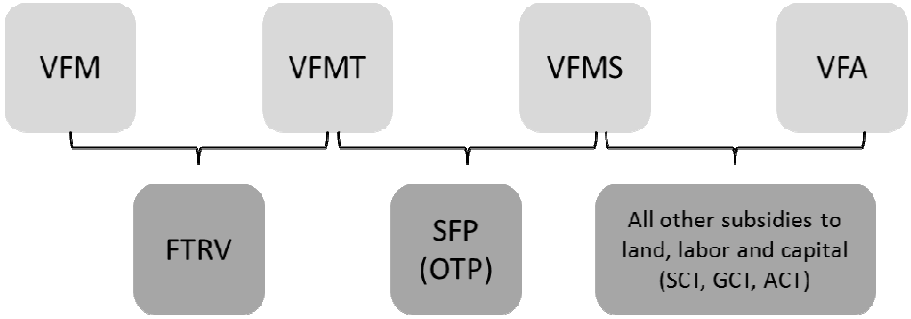
4 Empirical Analysis and Results

The analysis is conducted with the comparative static multi regional general equilibrium GTAP model that provides a detailed representation of the economy including the linkages

6 We have been working with an early pre-release of the version 8 data base where the method used to calibrate OTP payments into the data base differed from the final standard approach present in this paper. Therefore we start by recalibrating the standard approach into the data base using the same method as we use to make to alternative data bases. In so doing, we make our comparison of data bases more consistent by using the same program to calibrate all three data bases.

between farming, agribusiness, industrial and service sectors of the economy. All policy interventions are represented by price wedges. The framework of the standard GTAP model is well documented in HERTEL (1997) and available on the internet (www.gtap.agecon.purdue.edu). Results are presented in millions of US$ for the year 2007 of the GTAP database. The calculations are based on GEMPACK (Version 10.0) and RunGTAP (HARRISON and PEARSON, 1996).

Figure 4: Homogenous and non-homogenous support in GTAP



with
VFM_{ijr} producer expenditure on factor i by sector j in region r at agent's prices
$VFMT_{ijr}$ VFM_{ijr} plus factor employment revenue ($FTRV_{ijr}$)
$VFMS_{ijr}$ $VFMT_{ijr}$ plus homogenous support from OTP
VFA_{ijr} producer expenditure on factor i by sector j in region r at market prices

Source: Own graph, 2011.

According to the three alternative methods to distribute the OTP, we created three alternative GTAP data bases. One according to factor usage shares, one with 50% on land and capital 25%, respectively and the third one with 100% on land.

- BENCH: Factor usage
- SHR50-25-25: Prefix share of 50% on land, and 25% on labor and capital
- LAND100: Prefix share of 100% subsidy on land

These alternative data bases are used as starting points to run three simulations where the subsidy payments of the SFP are completely removed. In presenting the result of the response to the removal of the SFP we focus on output, import and export changes.

Figure 5: Scenarios

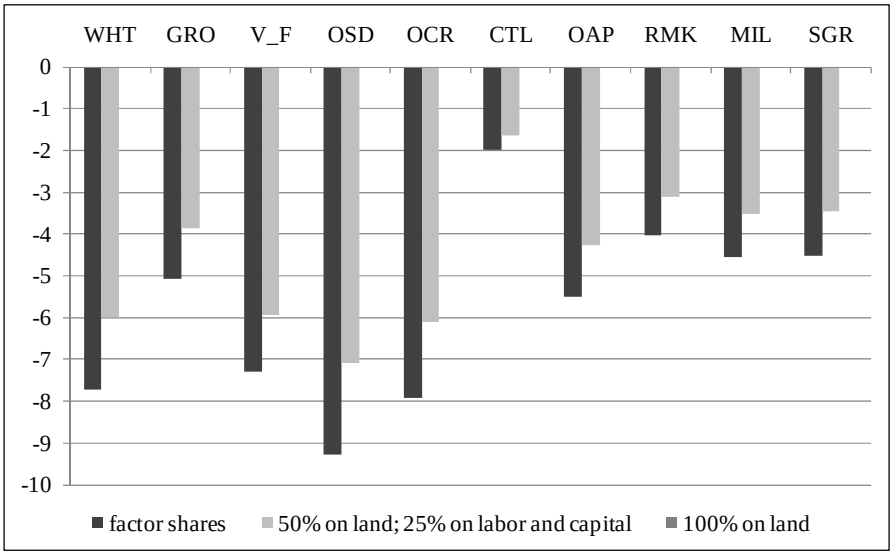
	Scenarios		
	1 BENCH	2 SHR50-25-25	3 LAND100
Distribution of the OTP/SFP in the GTAP data base according to:	Factor usage shares	50 % land 25 % labor 25 % capital	100 % on land
Policy Simulation	100 % Removal of SFP		

Source: Own graph, 2011.

In the Figure 6 we present the production effects for selected sectors in Germany. It can be easily seen that there are no production changes scenario LAND100, where the OTP payments are fully allocated to land. The reason for this is of course the homogenous subsidy rate to land which is solely used by the agricultural sectors. This mode of distribution of OTP in the GTAP data base should therefore be used, when we assume that the subsidies allocated to land can be regarded as completely decoupled from production. Furthermore, Figure 6 exemplifies that effects related to scenario BENCH, which is representing the distribution of OTP in the current GTAP data base 8.0, are higher than the one related to scenario SHR-50-25-25. This supports the presumption that the effects are smaller the higher the share of allocated OTP payments to land is. This pattern is also repeated in output effects for other EU countries.

Can we conclude from Figure 6 that the removal of the SFP causes negative production effects for all EU member states? Figure 7 illustrated the production effects in the cattle sector for selected EU member countries and the rest of the world (ROW). Here, similar findings are revealed compared to the previous graph. In scenario BENCH the removal of the SFP causes high output changes, while they are smaller for scenario SHR-50-25-25 and neglectable for scenario LAND100. Hence, the degree of decoupling is increasing in the GTAP data base from scenario LAND 100, to SHR-50-25-25, and is even higher in scenario BENCH.

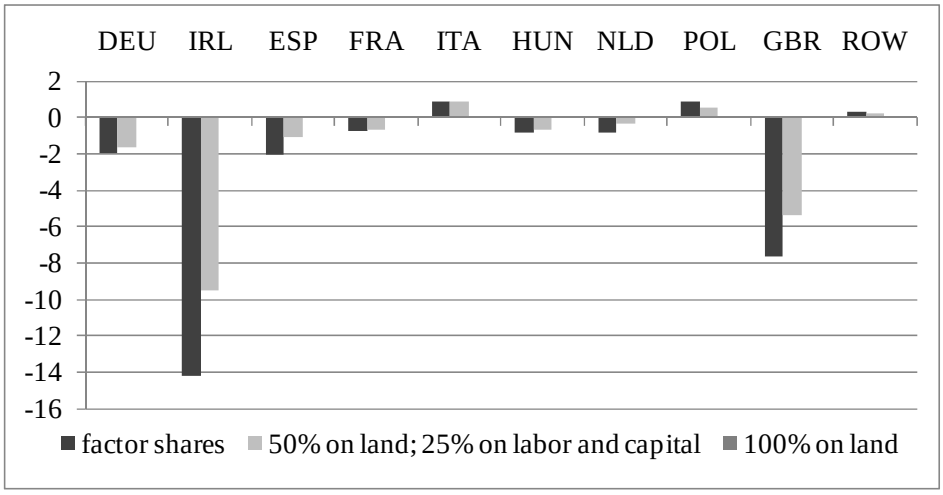
Figure 6: Production effects in Germany for selected products (%)[1)]



1) For abbreviations of sectors and regions refer to Table A2 and A3 in the appendix.

Source: Own calculation, 2011

Figure 7: Production effects of the cattle sector (%)[1)]



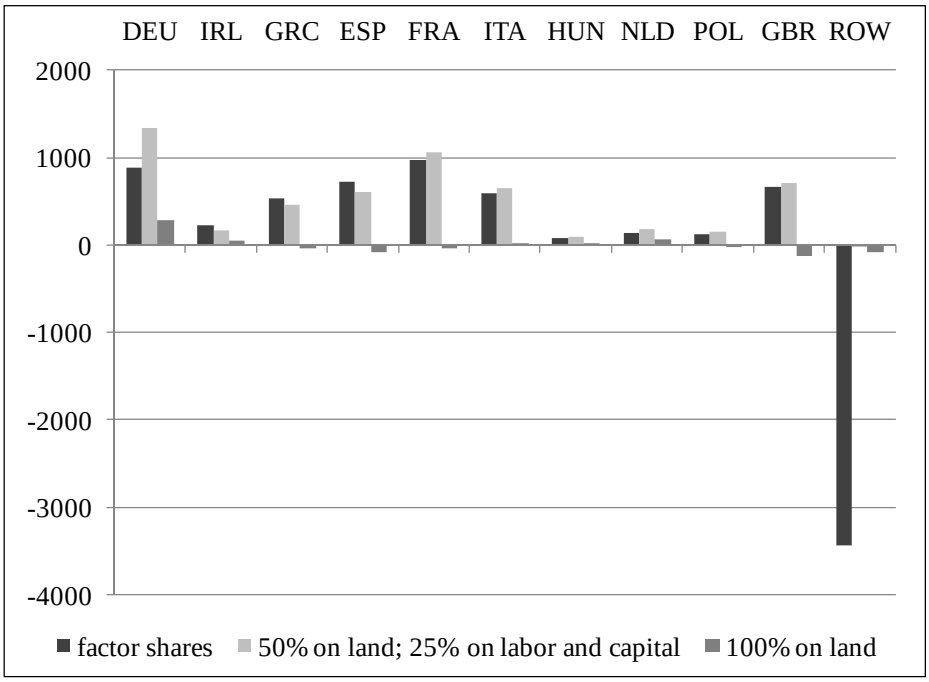
1) For abbreviations of sectors and regions refer to Table A2 and A3 in the appendix.

Source: Own calculation, 2011

The Figures above clearly shows variation of the production effects due to the mode of OTP distribution and subsequent removal of the SFP. Does the allocation of the OTP payments also have an impact on trade? Figure 8 presents changes in trade balance of selected EU member countries in US $ Mio. Here, the effects are obviously deviating from the pattern that we observed earlier. For some countries, e.g., Germany, France and United Kingdom the effects of the scenario SHR-50-25-25 are higher than for the scenario BENCH scenario. Furthermore, we of course only detect marginal effects in scenario LAND100. In contrast, some

regions reveal negative, but also very small effects which are again neglectable. Concerning the rest of the world, we can see an enormous negative impacts caused by scenario BENCH. If we indeed assume the SFP to be more or less decoupled than this approach to distribute OTP to the GTAP data base is clearly overestimating the effects of a removal of the SFP. In addition, it would be preferable to disaggregate the ROW region, to draw more specific conclusions.

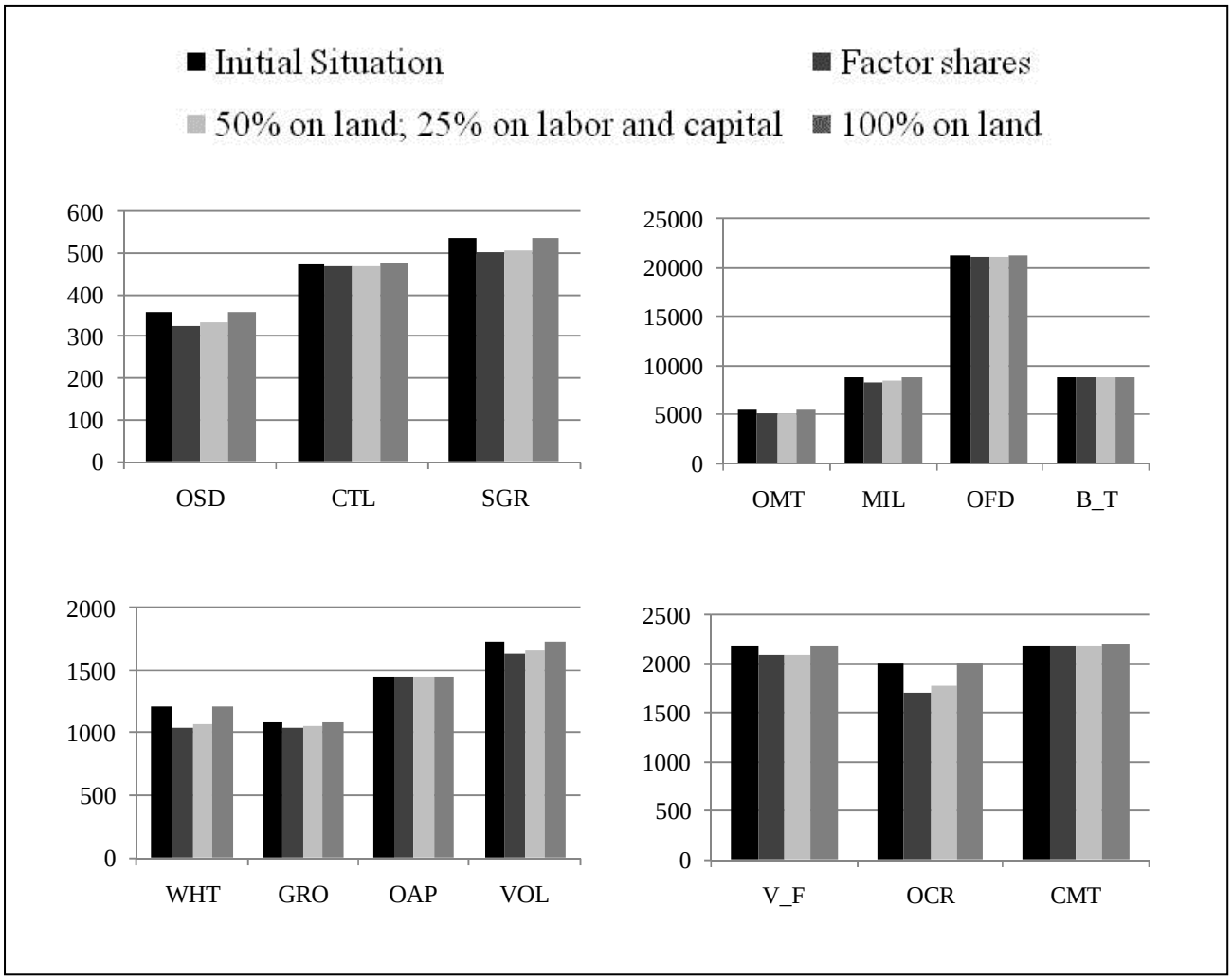
Figure 8: Change in Trade balance for selected countries in US $ Mio.[1)]



1) For abbreviations of sectors and regions refer to Table A2 and A3 in the appendix.
Source: Own calculation, 2011

In Figures 9 to 11 we present more details on bilateral exports (*VXWD*) and imports (*VIWS*) evaluated at world market prices. In these figures we first compare the initial GTAP base data with the updated base data after running the three scenarios BENCH, SHR-50-25-25 and LAND100. These changes are shown for *VXWD* as well as for *VIWS*. The changes between initial and the updated data base are particularly small for all livestock products (*CTL*) and beverages and tobacco (*B_T*).This effect is even more obvious when the processed food is considered (e.g., *OAP*, *CMT*, O*F*D). Higher effects can be observed in crop production where land is more important as production factor and thus, the degree of decoupling plays major role. This can particularly be seen in the wheat (*WHT*), oilseeds (*OSD*) and other crops (*OCR*) sector. Of course the scenario LAND100 is again closest to the initial situation.

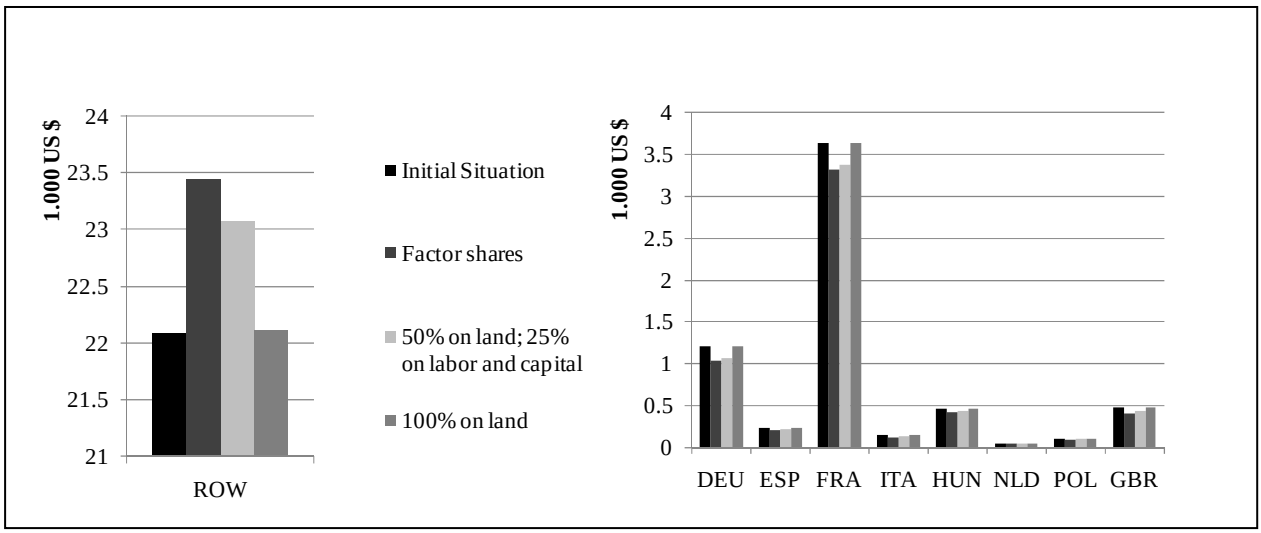
Figure 9: VXWD for German agricultural sectors in U.S. $ Mio.[1)]



1) For abbreviations of sectors and regions refer to Table A2 and A3 in the appendix.

Source: Own calculation, 2011

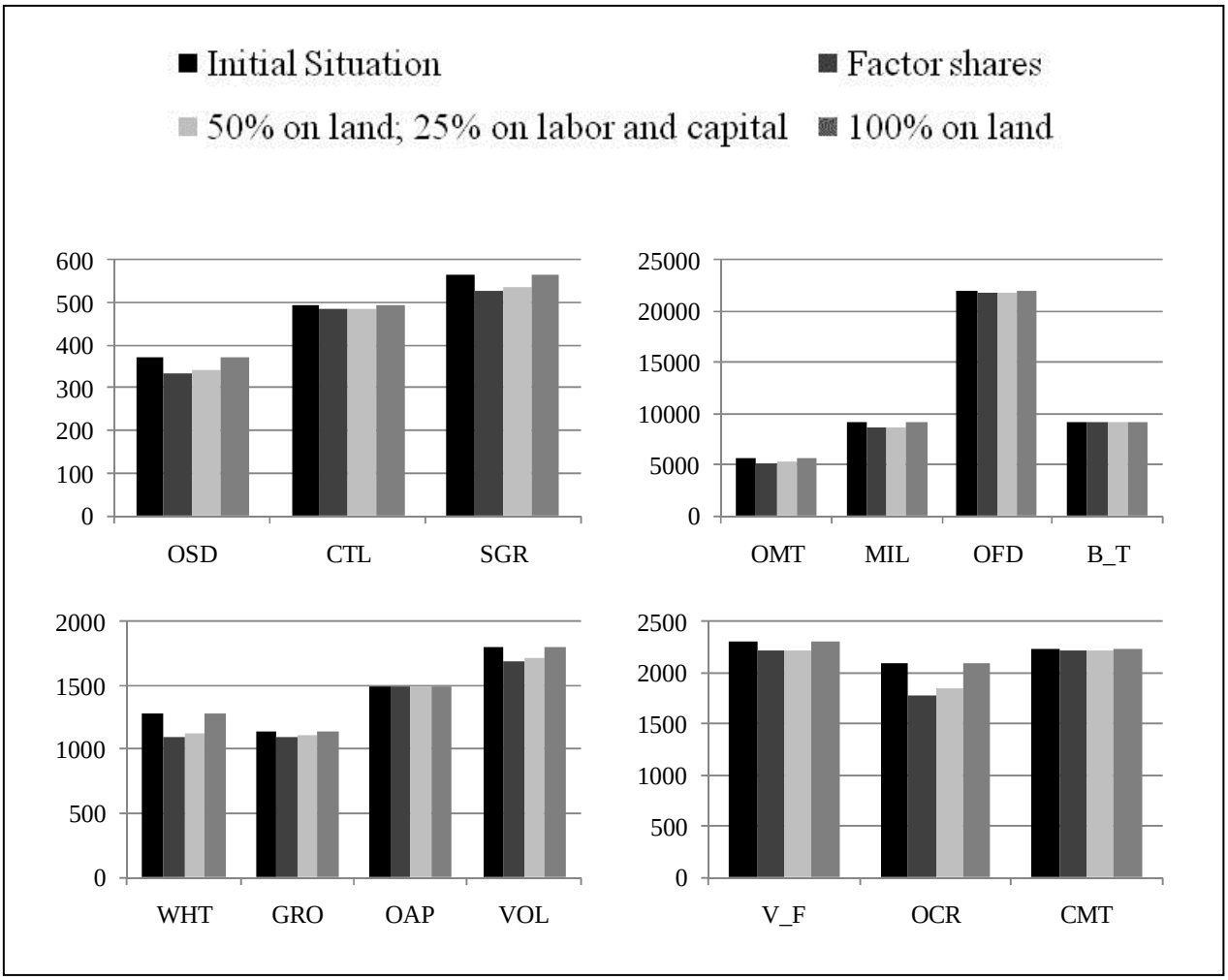
Figure 10: VXWD for the wheat sector in selected countries in U.S. $ Mio.[1)]



1) For abbreviations of sectors and regions refer to Table A2 and A3 in the appendix.

Source: Own calculation, 2011

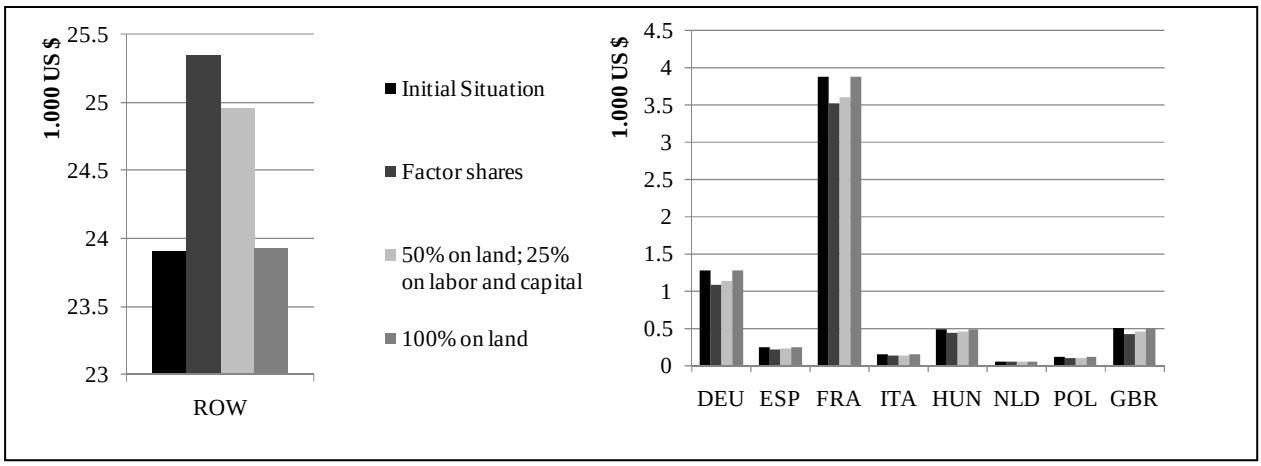
Figure 11: VIWS for German agricultural sectors in U.S. $ Mio.[1)]



1) For abbreviations of sectors and regions refer to Table A2 and A3 in the appendix.

Source: Own calculation, 2011

Figure 12: VIWS for the wheat sector in selected countries in U.S. $ Mio.[1)]



1) For abbreviations of sectors and regions refer to Table A2 and A3 in the appendix.

Source: Own calculation, 2011

Figure 10 and 12 shows once more that there are high differences according to the distribution mechanism that is utilized to allocate the OTP to the GTAP data base. Assuming an allocation of OTP based on factor shares (BENCH) leads to the highest effects on production and trade, when the SFP is removed. With an increasing allocation to land those effects tend to be smaller or even close to zero, if OTP is completely allocated to land (100LAND). If we want to consider the SFP's degree of decoupling to be higher, than the current GTAP data base clearly overestimates simulation results.

5 Conclusion

The EU's SFP is regarded as more or less non trade distorting. Reviewing the literature it is evident that decoupled payments still have an influence on production via various coupling channels, e.g., risk and wealth, credit constraints, land and labor allocation as well as farmers expectations of future policies. However, most authors not only state that these effects are rather modest, but that the effect of decoupled payments on land allocation and related production effects are the highest. Furthermore, effects of decoupling payments are mainly only estimated for selected coupling channels.

Based on this literature overview we conduct a sensitivity analysis on the mode of allocation of SFP payments in simulations models utilizing OECD PSE data and the GTAP framework. Our sensitivity analysis reveals strong differences in simulations results which are particularly pronounced in the production responses of the food and agricultural sector. Accordingly, results of trade liberalization including the removal of domestic support are highly sensitive to the mode by which SFP are implemented in simulation models. The current standard approach to calibrate the GTAP data base is based on a distribution of OTP according to factor shares which represents a high degree of coupling. A complete decoupling would be assumed, when OTP is complete allocated to land and distributed over production sectors using a homogenous subsidy rate. To improve on the implementation of SFP in simulation models one needs to employ more accurate coupling factors which are not available yet for the SFP and thus need to be econometrically estimated in future work.

6 References

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7 Appendix

A1: Literature review: How coupled are decoupled payments?

Author / year	Coupling channels	Research question	Method	Effect on production /output	Other effects
ANTÓN and LE MOUEL, 2002	Risk	Do counter-cyclical payments have an influence on production?	Acreage decisions under risk. Expected utility maximization in the context of a risk averse farmer. Mean variance approach to determine the magnitude of risk related incentives.	Increase production	
BHASKAR and BEGHIN, 2008	Risk, future expectations	Effect that expectations about base updating in future policies that have on a farmers acreage decision in the presence of price, yield and policy uncertainty.	Acreage optimization problem for risk neutral farmer. Stochastic dynamic programming.	Increase production	
BASKAR and BEGHIN, 2009	All	How decoupled from production are decoupled payments	Representative literature overview (past 10 years).	Increase in production	
CHAU and DE GORTER, 2005	Future expectations	Consequences of the direct payment schemes in agriculture on fixed costs, exit decisions and output	Generalized theoretical model of cross-subsidization.	Removal of decoupled payments can have an impact on exit decision (low-profit farm units) and on output level.	
FEMENIA et. al., 2010	Wealth effect, future expectations	Evaluation of coupling effects passing through the wealth of agricultural households.	Simulation model	Impact on / increase production	
GIRANTE et. al., 2008	Credit constraints	How production effects may have differed across farmers with varying levels of debt pressure.	Maximization of expected utility of wealth. Farmers acreage decisions.	(Small) increase production	
GOHIN, 2006	Land	Analyzing the effects of different degrees of capitalization	PE model	Effects on production	Increase in land rents
GOODWIN and MISHRA, 2006	Risk, wealth, credit constraints	Utilization of farm level data to evaluate to what extent decoupled payments distort production	Variety of empirical models to evaluate aspects of the distortion question.	Increase production	

A1: Literature review: How coupled are decoupled payments? (continued)

Author / year	Coupling channels	Research question	Method	Effect on production /output	Other effects
HENNESSY, 1998	Risk	Production effects of agricultural income support	Models a risk averse famer maximizing expected utility from profit.	Increase production	
JUST, 2011	Risk, wealth	Does decreasing risk aversion matter?	Following Hennessy and Antón and Moro Just uses utility of wealth function and develops a new calibration method to quantify the change in the concavity.	Cannot confirm increase in production	
JUST and KROPP, 2009	Future decisions	Production incentives from decoupling.	Model of production exclusion restrictions.	(Substantial) increase production	
KEY and ROBERTS, 2009	Labor allocation	Nonpecuniary benefits from farming	Household model, labor allocation decisions to maximize utility. Estimation of the wage-differential between on-farm and off-farm labor.	n.a.	Increase in on-farm labor supply; increases farmer's liquidity and reduces their reliance on off-farm work
KOUNDOURI et.al., 2009	Risk	Implications of EU CAP on farmers risk attitude.	Farmers maximization of expected utility of profit. Simultaneous estimation of production technology, risk attitudes and land allocation under production risk.	Effect on production through choice of crop mix and input use.	Effect on input use and crop mix
LATRUFFE and LE MOUEL, 2009	Land values	Effects on land rents created by agricultural subsidies.	Literature review to what extent agricultural subsidies translate into higher land values.	n.a.	Increase in supply price, effect on land price
LOBLEY and BUTLER, 2010	Future decisions, exit farms	Effects of the SFP on farmers decision making.	Cluster analysis	n.a.	
PETRICK and ZIER, 2011	Labor	Employment impacts of CAP measures	Difference in difference estimator, panel data approach.		Further decoupling steps may lead to job losses.

A1: Literature review: How coupled are decoupled payments? (continued)

Author / year	Coupling channels	Research question	Method	Effect on production /output	Other effects
RUDE, 2007	Production effects, land	Production effects of the SFP	Profit maximization by choosing the area allocated to each crop, the variable inputs and the shadow value of land.	Effect on production; impact of domestic support reforms on international agricultural markets will be modest.	
SCKOKAI and ANTÓN, 2005	Production effects, risk	Degree of decoupling for area payments. Test the theoretical explanation of why area payments in the EU may have smaller impacts on production than does price support	Estimation of a degree of decoupling.	Effect on production.	(The evidence does confirm the hypotheses in the majority of cases – larger area response to area payments, a negative yield response and a smaller total output response.)
SCKOKAI and MORO, 2009	Risk	Impact of SFP on farm investment and output	Dynamic dual model of farm decision making / of choice under risk.	Rather weak linkage between output and the dynamics of quasi-fixed inputs. Wealth and income transfer effect producer supply response.	
SERRA et. al., 2011	Risk	Farmers' behavior under risk and uncertainty	Expected utility model to analyze farmers' behavior under risk.	Negligible effects on production	
SERRA et. al., 2005	Risk	Effects of decoupling on output / production decision	Leathers and Quiggin model of production under uncertainty.	Decoupling result in a decline in the mean and variance of output by reducing the use of risk increasing inputs.	
TRANTER et. al., 2007	Land, production	Implications of the SFP on food production and land use	Simulation model	Effects on production	
VAN MEIJL et. al., 2006	Land use	Impacts of different policies on land use	GTAP model linked with the IMAGE model	Less production effects than coming from market support	Small negative impact on land use

A2 Regional Aggregation in GTAP

Countries and Regions		Abbreviation
1	Austria	AUS
2	Belgium and Luxembourg	BLUX
3	Denmark	DNK
4	Finland	FIN
5	France	FRA
6	Germany	DEU
7	Ireland	IRL
8	United Kingdom	GBR
9	Greece	GRC
10	Italy	ITA
11	Netherlands	NLD
12	Portugal	PRT
13	Spain	ESP
14	Sweden	SWE
15	Czech Republic	CZE
16	Hungary	HUN
17	Malta and Cyprus	CM
18	Poland	POL
19	Slovakia	SVK
20	Slovenia	SVN
21	Estonia	EST
22	Latvia	LVA
23	Lithuania	LTU
24	Bulgaria	BGR
25	Romania	ROM
26	Rest of the World: United States, Canada, Japan, Australia, New Zealand, Switzerland, Norway, Rest of EFTA, Albania, Croatia, China, India, Brazil, Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Panama, Rest of South America, Rest of Oceania, Rest of Caribbean, Mauritius, Zimbabwe, Botswana, South Africa, Hong Kong, Korea, Rest of East Asia, Indonesia, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Pakistan, Sri Lanka, Mexico, Costa Rica, Guatemala, Nicaragua, Rest of Central America, Belarus, Rest of Eastern Europe, Kyrgyzstan, Armenia, Georgia, Turkey, Rest of Western Asia, Egypt, Morocco, Tunisia, Rest of North Africa, Rest of South African CU, Cambodia, Lao People's Democratic Republic, Myanmar, Rest of Southeast Asia, Bangladesh, Rest of South Asia, Nigeria, Senegal, Rest of Western Africa, Rest of Central Africa, Rest of South Central Africa, Ethiopia, Madagascar, Malawi, Mozambique, Tanzania, Uganda, Zambia, Other Eastern Africa, Taiwan, Rest of North America, Russian Federation, Rest of Europe, Kazakhstan, Rest of FSU, Azerbaijan, Iran Islamic Republic, Ukraine	ROW

A3 Sectoral Aggregation in GTAP

Sectors		Abbreviation
1	Paddy rice	PDR
2	Wheat	WHT

3	Cereal grains nec	GRO
4	Vegetables, fruits, nuts	V_F
5	Oilseeds	OSD
6	Sugar cane, sugar beet	C_B
7	Plant-based fibres	PFB
8	Crops nec	OCR
9	Cattle, sheep, goats, horses	CTL
10	Animal products nec	OAP
11	Raw milk	RMK
12	Wool, silk worm cocoons	WOL
13	Meat: cattle, sheep, goats, hoarses	CMT
14	Meat products nec	OMT
15	Vegetable oils and fats	VOL
16	Dairy products	MIL
17	Processed rice	PCR
18	Sugar	SGR
19	Other food	OFD
20	Beverages and tobacco products	B_T
21	Manufacturing Coal, oil, gas, petroleum, coal products, Forestry, fishing, minerals, Textiles, wearing apparel, leather products, wood products, paper products, publishing, chemical, rubber, plastic prods, mineral products nec, ferrous metals, metals nec, metal products, motor vehicles and parts, transport equipment, electronic equipment, machinery and equipment, manufactures nec	Mnfc
22	Services Water, construction, trade, transport nec, sea transport, air transport, communication, financial services nec, insurance, business services nec, recreation and other services, PubAdmin/Defence/Health/Educat, dwellings	Services