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# IMPACTS OF 2003 CAP REFORM ON LAND PRICES: FROM THEORY TO EMPIRICAL RESULTS

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<sup>1</sup> The views expressed in this article are those of the authors, and not those of the OECD or its member countries.

**Abstract**

Based on a graphical model we analyse the impacts of the Fischler Reform on land prices and the capitalization of single farm payments (sfp) into land values. The model shows that if there are more sfp than eligible land, the capitalization ratio will not decline but rather increase due to the inclusion of animal premiums in the sfp. We can confirm our theoretical results for cross-section data on land rental prices in Bavaria in 2005. Empirical results indicate that sfp of the Fischler reform are more capitalized into rental prices than the coupled direct payments of the time prior to the reform.

**Key Words:** land rent, capitalisation of payments, CAP Fischler Reform

**JEL Code:** Q18, Q15, H22

## **Introduction**

In 2003, the European Union enacted the Fischler Reform of the Common Agricultural Policy (CAP). The main modification of this reform is the Single Payment Scheme (SPS), i.e. the replacement of payments paid per hectare or animal by so called single farm payments (sfp). sfp are decoupled from production but still linked to land, since a farmer can activate only as many sfp as he farms (eligible) hectares. While this change in policy is likely to reduce production response and is more in line with WTO provisions, its influence on land values remains ambiguous. The crucial question in this context is if the switch to sfp changed the extent to which payments are capitalized into land purchase and rental prices. Recently, some authors have discussed this point based on theoretical work. Courleux et al. (2008) and Ciaian et al. (2008) both formulate analytical models based on an agricultural economy with two profit maximizing producers. Kilian and Salhofer (2008) analyze sfp utilizing an aggregated graphical model. Main insights from these three papers are that the degree of capitalization depends on the ratio between sfp and eligible hectares, how the reform is implemented (what is quite different across member states), the tradability of sfp, heterogeneity in productivity change and eligibility of new entrants. Based on mainly expert interviews, Swinnen et al. (2008) provide first empirical results of the effect of the Fischler Reform on land markets in a descriptive manner. Empirical results of the degree of capitalization of decoupled payments using regression analysis exist for the FAIR Act of the U.S. (e.g. Goodwin et al., 2003; Roberts et al., 2003; Lence and Mishra, 2003). They reveal different levels of capitalization depending on the investigated region and program. For some programs empirical analyses gives evidence that up to 85% of an additional dollar paid for farmers is capitalized into land.

The aim of this study is twofold. First, we theoretically discuss the effect of the Fischler Reform on rental prices. In contrast to Courleux et al. (2008), Cianian et al. (2008) and Kilian and Salhofer (2008) we compare the Fischler Reform to the situation before the reform and not to a hypothetical non-intervention situation. Second, we empirically test for the influence of the new payments on the rental price of land and the capitalization ratio. The rest of the paper is structured as follows. Section 2 provides a graphical analysis of the land rental market before and after the Fischler Reform. Section 3 uses regression analysis to investigate the influence of MacSharry coupled payments and Fischler decoupled payments on land rental prices and capitalization ratio for Bavaria. We draw some conclusions in section 4.

## **Capitalization – Theoretical Model**

To discuss the effect of the Fischler Reform on land markets we develop a simple graphical model. We first discuss the situation before the reform with the AGENDA 2000

regulations in place. In Figure 1  $VMP_{land}$  is the willingness to pay for agricultural land if no subsidies would exist. For the land rental market  $VMP_{land}$  is the expected value of marginal product for each year of the rental contract (von Witzke et al., 2007). For the land sales market  $VMP_{land}$  is equal to the (net-) present value of land, i.e. the sum of expected and discounted returns from owning the asset land (Weersink et al., 1999). In the following, we will consider the rental market of agricultural land and assume that the length of a rental contract is one year. However, this model can easily be adopted for the purchase market.  $VMP_{land}$  is assumed to be positive up to  $A_{ma}$ . Keeping land to the right of  $A_{ma}$  in production still can make sense, if it is coupled with subsidies. Instead of planting something on their land, farmers can sometimes also decide to voluntarily set-aside land and still receive area payments. Assuming that the costs of setting land aside is  $mc$ ,  $A_{mc}$  denotes the point where the costs of setting aside land are equal to the value of marginal product.

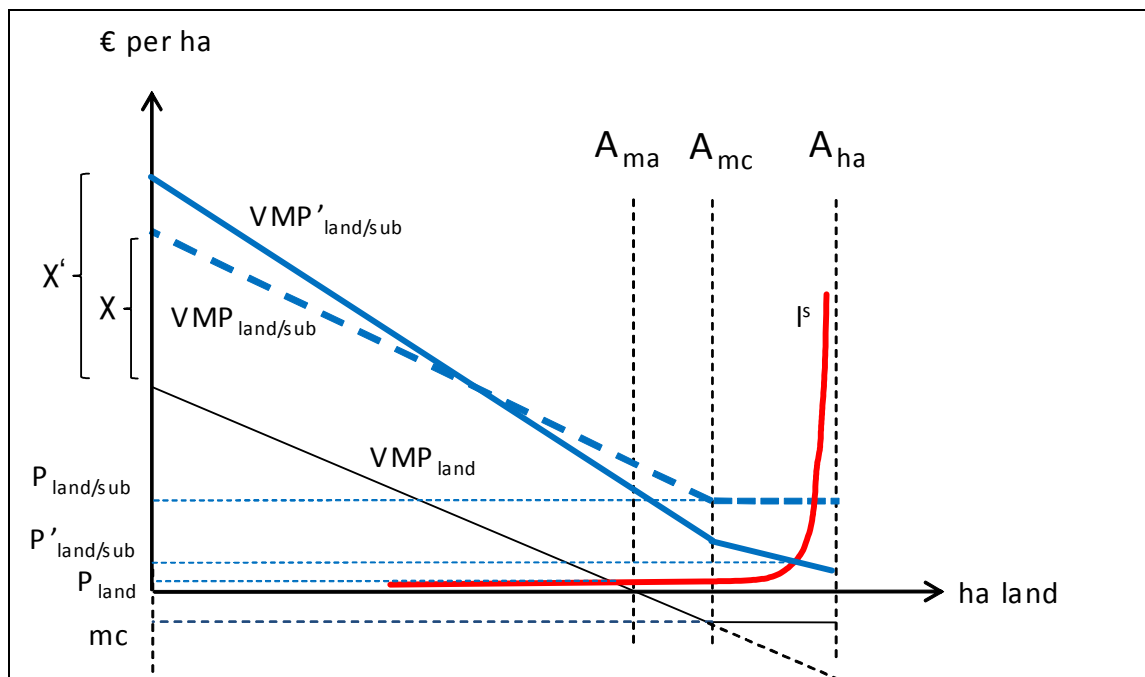
Before the Fischler Reform farmers received area payments as well as animal payments. Area payments are directly coupled with land and can be modelled as a subsidy  $a$  on the input factor land (e.g. Dewbre et al. 2001). Area payment  $a$  shifts the VMP curve upward. The degree crucially depends on the elasticity of substitution between land and the other input factors and the factor supply elasticities (Floyd, 1965; Latruffe and Mouel, 2006). Hence, in Figure 1  $VMP_{land/sub} - VMP_{land} = \chi = \alpha a$ , with  $\alpha \leq 1$ . In case of a zero elasticity of substitution between land and other input factors or perfectly elastic supply of other input factors  $\alpha = 1$ . In all other cases a subsidy on land implies some changes in other input markets and  $\alpha < 1$ . Supply of agricultural land ( $I^s$ ) is assumed to be highly elastic for low prices, because there are hardly alternative uses, and very inelastic for higher prices, when land in production is near total available agricultural land  $A_{ha}$ . In the case of perfectly inelastic land supply the shift  $\chi$  will be equal to the difference in equilibrium land prices:  $\chi = P_{land/sub} - P_{land}$  where  $P_{land/sub}$  and  $P_{land}$  are the price of land with and without subsidies, respectively. In this particular case and with  $\alpha = 1$  subsidy  $a$  is exclusively capitalized into land prices and realized by land owners only. In all other cases the rent is shared by landlords, tenants and suppliers of other inputs. The capitalization ratio  $C$  is given by  $C = (P_{land/sub} - P_{land})/a$  with  $0 \leq C \leq 1$ .

Beside area payments farmers received also animal payments before the Fischler Reform. Animal payments will also be capitalized into land values to some extent. They can be seen as a subsidy on output (animals) for which to produce land is an input. Hence, animal payments will also shift the VMP curve upward. However, it has been shown that given the same absolute amount of subsidy, this shift will be smaller (Dewbre et al. 2001; Alston and James, 2002; Guyomard et al 2004) for the output subsidy. Again, the elasticity of substitution and factor supply elasticities determine by how much the  $VMP_{land}$  curve is shifted upward. In a simple

manner we can model the whole shift by  $VMP_{land/sub} = VMP_{land} + \chi$ , with  $\chi = \alpha a + \beta b$ , where  $b$  is animal payments and  $\beta$  is the extent to which  $b$  shifts  $VMP_{land}$ . We can assume  $\beta < \alpha$ .

The rental price of land ( $P_{land/sub}$ ) is given by the intersection of the supply curve  $l^s$  and the demand curve  $VMP_{land/sub}$ . There is some empirical evidence that this intersection is right to  $A_{ma}$ , e.g. von Witzke et al. (2007) estimate a negative rental price for agricultural land without subsidies for Germany in 2005. Before the Fischler Reform there was also a mandatory set-aside obligation. If the amount of land to which set aside was mandatory is larger than  $A_{ha} - A_{mc}$ , the vertical part of the supply curve would shift to the left and intersect with the  $VMP_{land/sub}$  curve in its down sloping part and the price for land would be higher. Cross Compliance regulations decrease the value of marginal product and hence shift  $VMP_{land}$  downward. Modulation decreases the subsidy per hectare and implies a smaller  $\chi$ .

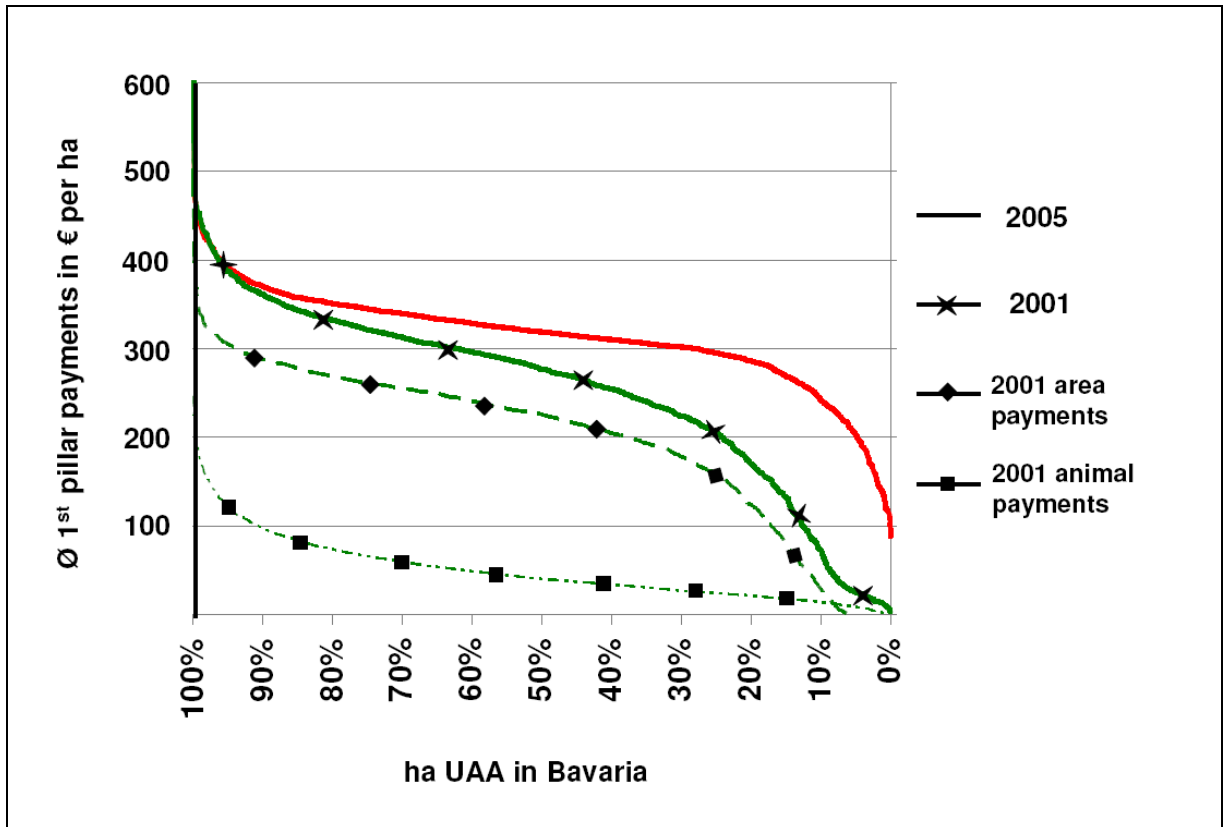
**Figure 1: Land rental market before the Fischler Reform**



We have modelled as  $VMP_{land/sub}$  in Figure 1 a payment that is equal across all hectares of land. However in general subsidies ( $a$ ,  $b$ ) are not the same for all hectares. We discuss this question by introducing Figure 2. It shows on the horizontal axis the cumulated payments per hectare based on data at the municipality level) and on the vertical axis the value of the sfp. The 2001 line in Figure 2 shows the distribution of payments before the Fischler Reform in Bavaria.

It becomes obvious by this figure that subsidies were not distributed uniformly across land. Let's assume that the land with higher subsidies per ha is demanded first, then the shift of the VMP curve due to the payments can be modelled in a simple way by a non parallel shift to  $VMP'_{land/sub}$  in Figure 1.

Figure 2: 1st pillar payments per hectare in Bavaria (1999 – 2013)



source: own presentation, based on ZID (2008) and StMLF (2008)

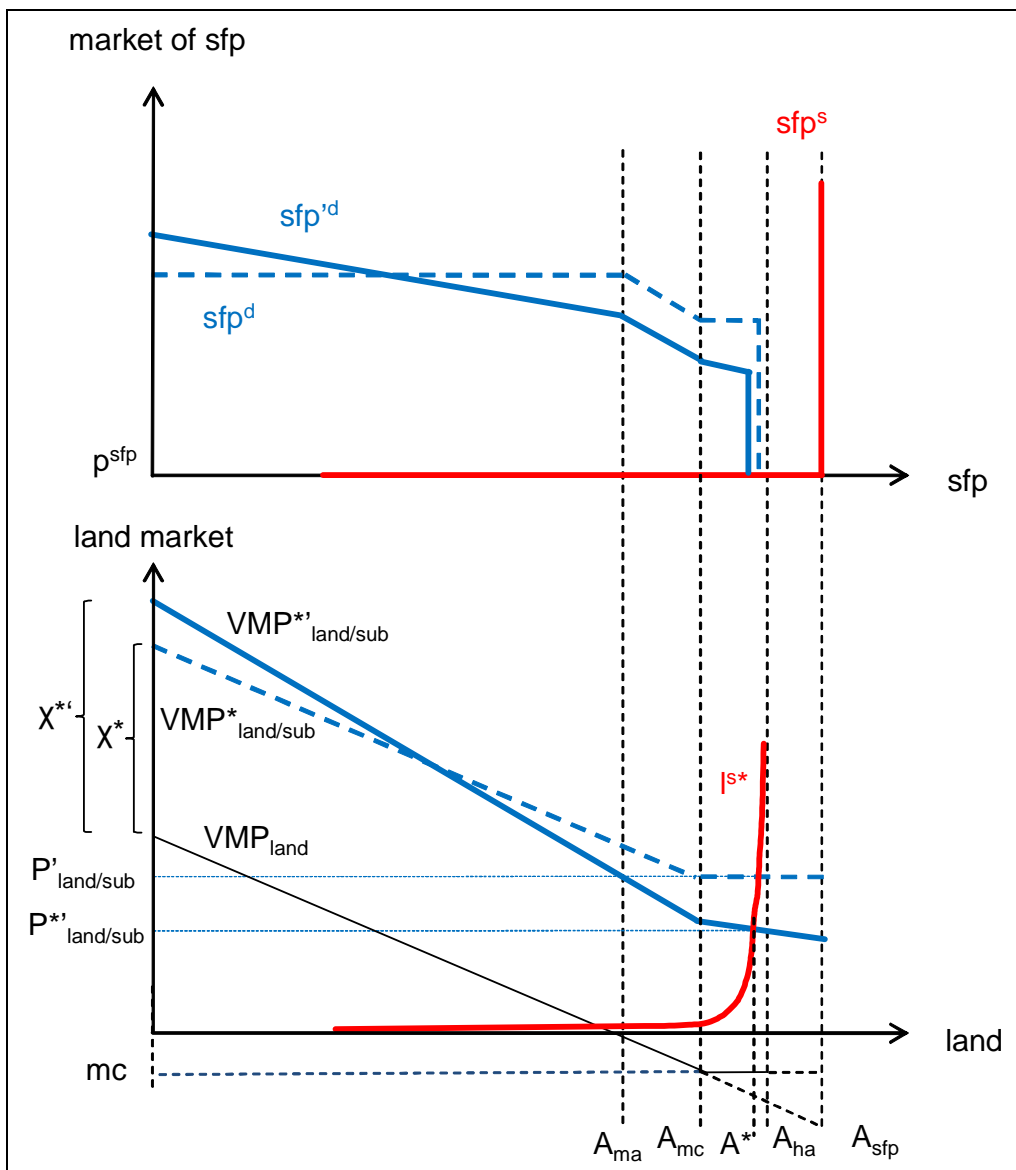
The main change of the Fischler Reform is the introduction of the SPS. However, member states (MS) had some degrees of freedom in implementing the SPS. In particular, we can distinguish between three different implementation models. In the historical model farmers receive sfp based on the average of their payments in the reference period between 2000 and 2002. This average payment is divided by the number of hectares farmed in 2005. So the value of all sfp equals the average payment and the number of sfp equals farmed hectares in 2005. In the regional model the sum of payments a region received between 2000 and 2002 is divided by the farmed hectares in this region. Hence, each entitlement has the same value unlike in the

historical model. The hybrid model is a mixture of the first two models. Therefore, the value of each sfp has a regional part (the same for each entitlement) and a historical part, depending on each farm's former payments.

Sfp are tradable. Thus in modelling the situation after the Fischler Reform in Figure 3, we assume a second market beside the land market, the market for sfp. However, since each sfp can only be activated with a corresponding hectare of eligible land there is a strong connection between the land market and the market for sfp. Farmers do not have to actually produce something on their land. It is enough to maintain it in good agricultural condition by fulfilling minimum requirements. We assume that the costs of fulfilling these minimum requirements are the same as for setting aside land previous to the reform (*mc*).



Figure 3: Land and sfp markets after the Fischler Reform with a surplus of sfp



The upper part of Figure 3 depicts the market for sfp. On the horizontal axis we have the quantity of sfp and on the vertical axis the price. In the case of the historical model sfp are heterogeneous, i.e. they have different values. This is illustrated by the continuous and decreasing  $sfp^d$  curve. The negative slope of this curve is justified by the assumption that sfp with a higher value are used first and low sfp are replaced by higher value sfp. Hence,  $sfp^d$  represents the demand curve for sfp. To keep things simple we assume that entitlements can be

rented like a milk quota for a year<sup>2</sup>. If a farmer owns land with a positive return (left to  $A_{ma}$ ) the price she is willing to pay for a sfp is the expected government payment. If she owns land with a negative return (right to  $A_{ma}$ ) this price is decreased by that negative return. Right to  $A_{ha}$  the price for an entitlement is zero since there is no land to activate an additional sfp. In the case of the regional model each sfp has the same value and  $sfp^d$  illustrates demand for sfp. The hybrid model is somewhere between the historical and the regional model.

Let's first look at a situation where the number of sfp ( $A_{sfp}$ ) is larger than the number of hectares to activate them ( $A_{sfp} > A_{ha}$ ). This case is represented in Figure 3 with sfp supply being depicted by  $sfp^s$  and a market price for entitlements ( $p^{sfp}$ ) of zero. Farmers with more sfp than hectares are willing to sell these sfp at any price and will compete until a price of zero. On the other side, let's assume that a farmer with a surplus of sfp wants to buy land to be able to activate all sfp. The maximum willingness to pay for this land is  $VMP_{land}$  plus the sfp given that the value of a sfp without land is zero. sfp become like a subsidy on land (Corleux et al. 2008) as before the reform, and will shift the demand for land upward by  $\chi'^*$  from  $VMP_{land}$  to  $VMP'^*_{land/sub}$ . In the historical model the sfp per farm is based on the payments between 2000 and 2002. Hence, the absolute amount of payments for a single farm did not change with the reform. However, as shown in Figure 3 in the case of a surplus of sfp all payments now act as payments to land. If all payments before the reform would have been transferred via area payments the shift in land demand would ceteris paribus be the same before and after the reform, i.e.  $\chi' = \chi'^*$ ,  $VMP_{land/sub} = VMP'^*_{land/sub}$ ,  $P'_{land/sub} = P'^*_{land/sub}$  and  $C' = C'^*$ . However, Figure 2 illustrates that, although area payments were the more important ones, there were also considerable animal payments. As discussed above animal payments are output subsidies and will shift the VMP curve to a lesser extent implying  $\chi' < \chi'^*$ ,  $VMP_{land/sub} < VMP'^*_{land/sub}$ ,  $P'_{land/sub} < P'^*_{land/sub}$  and  $C' < C'^*$ . Moreover, with the Fischler Reform former price support for milk and sugar was included in the sfp. This higher absolute amount of direct payments is illustrated for Bavaria in Figure 2 with the 2005 line being to the right of the 2001 line for all observations. Given this we can even more expect that  $P'_{land/sub} < P'^*_{land/sub}$  and  $C' < C'^*$ . There are two changes with the Fischler Reform which might mitigate this result. First, the value of sfp will decrease over time due to modulation. Second, cross compliance regulation imply costs to farmers and hence decrease the value of marginal product.

Figure 3 also depicts the difference in land price between historic and regional model. We expect higher marginal land prices in case of the regional model ( $P^*_{land/sub} < P'^*_{land/sub}$ ) due to a

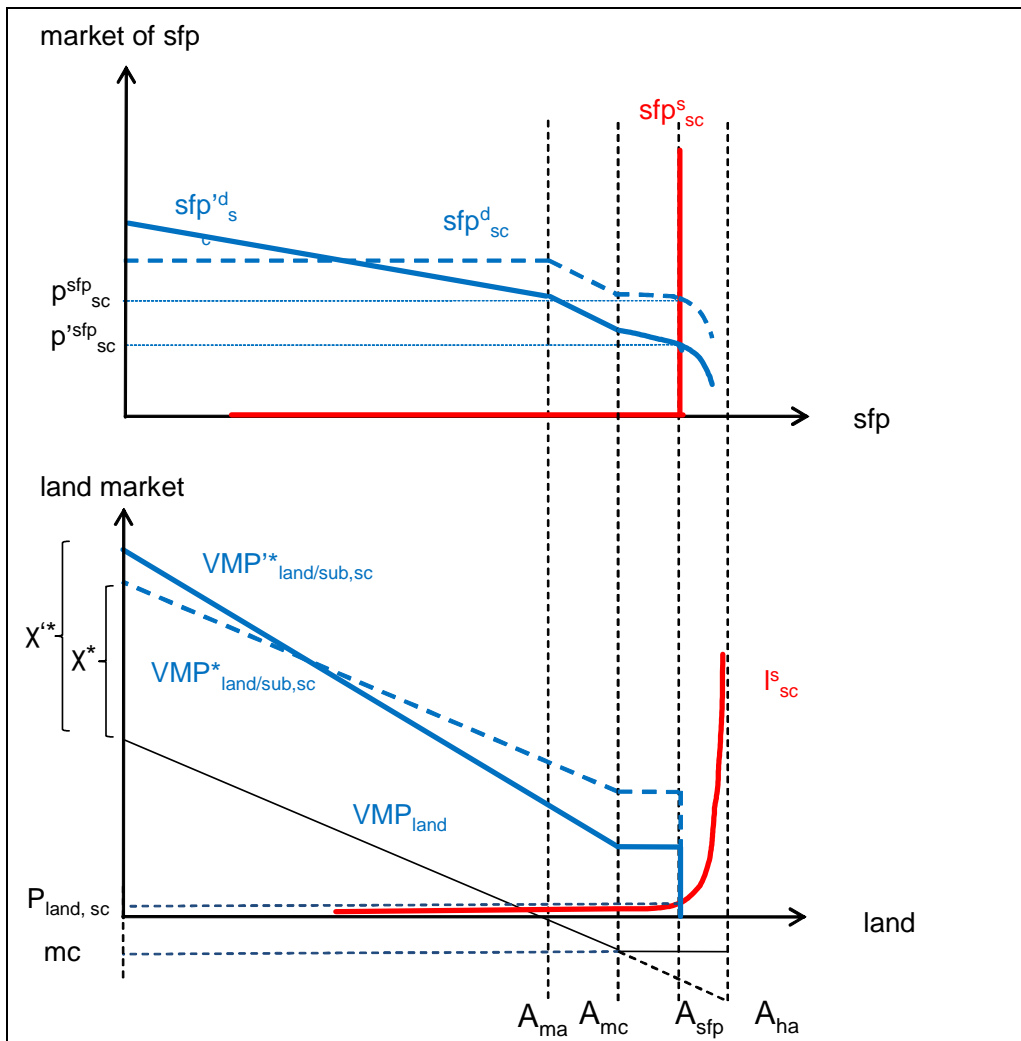
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<sup>2</sup> In reality sfp entitlements can only be rented with land, but they can be sold and bought without land. However, this assumption is without any consequences for our derived result.

higher value of the marginal payment. The price of land in case of the hybrid model will be somewhere in between.

The land and sfp market after the implementation of the Fischler Reform may also be characterized by scarcity of sfp ( $A_{ha} > A_{sfp}$ , Figure 4).

**Figure 4: SPS – scarcity of sfp**



In this case a larger area of land competes for a smaller number of sfp. Thus, the limiting factor is sfp. Demand for land ends at  $A_{sfp}$  since no farmer would cultivate unproductive land without payments. Hence, in case of scarcity of sfp the price of land is down to  $P_{land,sc}$ . Price of land will be lower than in case of surplus of sfp ( $P^*_{land,sc} < P^*_{land/sub}$ ). Landowners are willing to activate a sfp on their land. They bid  $p^{sfp}_{sc} = VMP_{land} - P_{land,sc}$  (as opportunity costs) for a sfp. Therefore, we expect a high degree of capitalization of government payments into the sfp market

value. Following considerations of the land market in case of surplus of sfp, we expect lower prices for sfp in the historical model than in the regional model (and the hybrid model respectively). Unlike in the cases of sfp surplus, the area under CAP system is not determined by  $A_{ha}$  but by  $A_{sfp}$ .

Summarized, our theoretical considerations show the importance of the relation sfp to eligible land. If there are more sfp than land we would expect no decrease of rental prices and capitalization but rather higher capitalization and rental prices due to the inclusion of former animal payments. If sfp are scarce capitalization and rental prices were expected to decrease with the implementation of the Fischler Reform. In the empirical part we will test if the capitalization ratio has increased or decreased with the reform.

## **Empirical Evidence**

Our data set contains observations of 2005, the first year with SPS implemented, at the municipality level in Bavaria. Data sources are the Bavarian State Office for Statistics and Data Processing (LfStaD), the Central Integrated Administration and Control System Database (ZID) database, the Bavarian Ministry of Agriculture and Forestry (StMLF), the Bavarian State Office for Taxes (LfSt), the Association for Technology and Structures in Agriculture (KTBL) and the Bavarian State Research Centre for Agriculture (LfL). Bavaria is the largest Federal State of Germany in regard to agricultural area and is divided into 2056 municipalities. The rental prices are from a stratified random sample of all Bavarian farms. Additionally, in order to comply with the regulations on the protection of personal information and to reduce the impact of spurious data only municipalities with a minimum of seven observations for the dependant variable are included. Therefore, we can use between 1072 and 1154 observations in our regressions. All regressions are cross section and this can be a limitation of our analysis that will be tackled in next versions of this work.

Table 1 gives a descriptive statistics of our variables. The dependant variable is the average rental price for either cropland or total utilized agricultural land. Explanatory variables include proxies for natural conditions, farm and market structure as well as public payments. We use 11 dummies to control for the heterogeneity in 12 different agricultural regions in Bavaria and the soil quality index (1-100) to differentiate natural conditions within these regions. Farm and market structure is described by several variables. The average plot size accounts for the fact that land consolidation has not taken place to the same extent in all regions. The share of rental area explains differences in the demand and supply for land. The number of farms per 100 ha utilized agricultural area (UAA) takes into account the differences in farm size. The share of UAA on total land area provides an indication for the general importance of the agricultural

sector in a region. Finally, the variable installed biogas power accounts for the impact of the increasing importance of renewables after the amendment of the renewable energy legislation in 2004.

To investigate the effect of public payments on rental prices we include decoupled payments of the Fischler Reform in 2005. Due to the hybrid SPS model in Germany, decoupled Fischler Reform payments are composed of a regional part and historic part. The regional part corresponds to a great extent to former area payments, while the historic part corresponds to animal payments. We also include agri-environmental and less favoured area payments in our regression. The estimated coefficients of these variables can be interpreted as the capitalization ratios of different payments. The observed rental prices of 2005 are to some extent based on contracts signed before that year. Hence, we created a dummy that gives the share of area which is rented based on a contract in 2005. This is a dummy between 0 and 1. For example a value of 0.1 shows that 10 % of the sample area is based on contracts signed in 2005. For the regression we multiply this dummy with the corresponding sfp payments. Hence, the estimated coefficient of this variable can be interpreted as the difference in the capitalization ratio between payments before and after the reform.

**Table 1. Descriptive statistics**

Variables and Definition	Mean	Std.Dev.
<b>dependant variables</b>		
rental price of cropland (€/ha)	261.509	106.778
rental price of utilized agricultural land (€/ha)	238.740	103.507
<b>explaining variables</b>		
decoupled 1 <sup>st</sup> pillar payments, DecP (€/ha)	301.276	61.643
historic (farm specific) part of DP	103.458	50.456
regional part of DP	197.817	60.072
agri-environmental payments (€/ha)	71.026	50.898
payments for less favoured areas	48.583	57.508
share of area of new rental contracts on all contracts	0.043	0.073
soil quality index (1-100)	43.185	9.872
seize of a cultivated plot (ha)	1.477	0.544
share of rental area	0.506	0.103

farms per 100 ha UAA	3.984	1.928
share of UAA on total land area	0.560	0.247
Installed biogas power (kW/ha)	7.455	5.674
Dummy for agricultural regions (AG 1-12) with similar agricultural conditions		

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Empirical results of regressing the payments and other factors on cropland and on UAA rental prices in 2005 are shown in Table 2. All regressions control for heteroskedasticity with White's robust standard errors (1980) since the Preusch-Pagan (1979) test and the White's heteroskedasticity test (1980) indicated heteroskedasticity. A Wald test confirmed the significance of the 11 agricultural region dummies. By estimating a two stage least squares (TSLS) regression with payments of 2007 as instrumental variable (IV) for 2005 we account for the expectation error in payments. At the time the rental contract is signed, farmers can only expect the amount of payments in the following years. The difference between expected and realized payments leads to a bias of coefficients towards zero in the OLS regression. Analogous payments of a different year serve as a good instrument since they are highly correlated ( $> 0.9$ ) with the actual payments but not with the expectation error. The Hausman test for endogeneity (Hausman, 1978) confirms for all regressions endogeneity of decoupled payments and hence confirms IV regression techniques. A comparison of OLS and IV estimations confirms the theoretical considerations. Estimated capitalization ratios derived by IV estimations are larger and more significant. Because of space limitations we only present IV estimation results.

The influence of direct payments on rental prices is highly significant for both cropland only and agricultural land in general. We divided direct payments in their regional and historical part. The regional part of the payment is capitalized stronger into rental prices than the historical part. A big share of our rental prices are based on contracts before 2005. The amount and distribution of subsidies did not change very much with the reform. As mentioned above, the regional part reflects to a great extent the area payments and the historic part animal payments. Hence, these variables depict to a great extent the capitalisation ratio before the Fischler Reform. As hypothesized in the theoretical part animal payments are capitalized to a smaller extent ( $\alpha > \beta$ ). Differences in the capitalisation ratio before and after the reform are accounted for in the dummy described above. We find that the capitalization of payments is higher in recent rental contracts. Tenants shift additionally 15 to 19 Cents of every Euro of payments to the land owners. Coefficients of agri-environmental payments show a negative sign. Agri-environmental payments are often linked to (voluntarily farm individual accepted) restrictions in cultivation and therefore generally paid in regions with lower soil quality. From this view, the negative sign implicates undercompensation for the restrictions. Payments for less favoured areas are only significant for crop 2005. A positive sign for these payments which are area-wide and can not be

influenced by the way of farming may indicate capitalization in land rents in contrast to foresaid agri-environmental payments. As expected, rental prices increase with the soil quality and plot seize. The highly significant negative coefficient of the share of rental area may show, that stronger competition for land leads to lower rental prices. In line with this, more farms per UAA increase rental prices. The positive coefficient of the share of UAA on total land indicates either lower rental prices in more urban regions with higher cultivation restriction or lower land quality in regions with a higher share of forest. Finally, a higher biogas production concentration also leads to higher rental prices.

**Table 2: Regressions results**

	cropland	UAA
DP regional part	<b>0.413</b> -	<b>0.777</b> -
DP historical part	<b>0.350</b> -	<b>0.280</b> -
Additional capitalization of 2005 rental contracts	<b>0.197</b> -	<b>0.164</b> -
Agri-environ payments	<b>-0.220</b> -	<b>-0.063</b> -
Payments for less favoured areas	<b>0.292</b> -	<b>0.191</b> -
soil quality index	<b>3.616</b> -	<b>3.823</b> -
seize plot	<b>51.923</b> -	<b>38.966</b> -
share or rental area	<b>-112.083</b> -	<b>-84468</b> -
farms per UAA	<b>2.601</b> - (1.825)	<b>8.966</b> -
share of UAA on total land	<b>55.087</b> -	<b>87.104</b> -
biogas power	<b>0.633</b> - (0.452)	<b>0.845</b> -
AG 1	<b>-30.933</b> -	<b>17.819</b> -
AG 2	<b>-11.550</b> -	<b>-3.434</b> -
AG 3	<b>-56.799</b> -	<b>-10.989</b> -
AG 4	<b>-50.771</b> -	<b>-35.078</b> -
AG 5	<b>4.136</b> -	<b>7.937</b> -
AG 7	<b>-58.473</b> -	<b>-38.053</b> -
AG 8	<b>-77.107</b> -	<b>-47.823</b> -
AG 9	<b>-73.900</b> -	<b>-72.706</b> -
AG 10	<b>-73.213</b> -	<b>-55.569</b> -
AG 11	<b>-22.300</b> -	<b>-18.890</b> -

AG 12	<b>-39.662</b> -	<b>-26.840</b> -
N	1072	1154
R <sup>2</sup>	0.54	0.59

numbers in parentheses show the standard errors, the statistical significance is shown: \*=90%, \*\*=95%, \*\*\*=99%

## Discussion

The Fischler Reform of the CAP in 2003 replaced area payments and animal payments of the MacSharry Reform 1992 and the AGENDA 2000 by so-called decoupled payments. These payments are no longer coupled to production output but still to agricultural land. Farmers obtained sfp which they can activate together with one hectare of agricultural land. The Fischler Reform strengthened the position of the EU in the WTO Doha Round since EU-decoupled payments are now eligible for the green box. However, it is less clear if the Reform can reduce the problem that agricultural transfers are realized by landowners rather than farmers. This is especially true for Germany where 60 percent of total agricultural land is rented.

In this paper, we develop a graphical model to analyse the impacts of the Fischler Reform on land prices and capitalization ratio. The theoretical analysis shows that if there are more sfp than land capitalization of payments do not decline but may be even higher since animal premiums are now included in the sfp. Before the Fischler Reform animal premiums were output premiums with probably lower capitalization than decoupled payments. A similar argument can be made for replacing high support prices for milk and sugar beets with not being part of sfp.

Our empirical results support these considerations that today's decoupled payments would be more capitalized into rental prices than coupled direct payments between 1992 and 2004. We found that 1 additional Euro of direct payments would increase rental prices by 28 to 78 Cents. Additionally, we evaluated if the Reform had any influence on the capitalization ratio. We found that the capitalization ratio to be higher after the reform. Additional 15 to 19 Cents are capitalized into rental prices. Given our theoretical model the higher capitalization ratio suggests that there are more sfp than eligible hectares to activate them. This is in line with findings from Roeder and Kilian (2008) that the prices paid for entitlements in Germany are rather low.

Summarizing our results, land price and capitalization ratio will not decrease due to the Fischler Reform. Therefore, EU member states may have competitive disadvantage in increasingly liberalized international markets. A solution might be to decrease the number of sfp and by that shift the capitalization from land to entitlements. Another option is the so called Bond scheme proposed by Swinbank and Tangermann (2004). They suggest a transition of payments in completely decoupled, tradable bonds. In addition, different implementation models



may lead to different effects on land prices within the EU. Therefore, a harmonization is required.

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