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Capitalization of the SPS into Agricultural Land Rental Prices under Harmonization of Payments

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This paper provides estimates of the capitalization of the Single Payment Scheme (SPS) payment of the Common Agricultural Policy (CAP) on agricultural land rental rates. We address problems of unobserved heterogeneity and sample selection. As the 2013 CAP Reform calls for the harmonization of SPS payments, we estimate the implications of this mandate on agricultural land rental rates over time as Germany began harmonizing payments in 2010. Using Bavarian farm level panel data we find strong capitalization effects that increase substantially in the years following 2009. On average, the marginal effect on rental rates of an additional SPS euro is 38 cents, growing over time to 57 cents as harmonization develops.

JEL Classification codes: C33; Q15; Q18

Keywords: CAP Reform, Capitalization Effect, Sample Selection, Panel Data, German Farms

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1. Introduction

Since the 1990s the Common Agricultural Policy (CAP) of the European Union (EU) has transitioned through a series of reforms aimed at moving away from coupled price supports to decoupled direct payments. The Fischler Reform of 2003 continued this transition to a more fully decoupled policy with the introduction of the Single Payment Scheme (SPS) in 2005. Farmers now own a specific number of tradable entitlements which can be activated every year if the farmer owns or has rented at least the same amount of eligible hectares of agricultural land. To receive payments farmers are not obliged to plant anything on these eligible hectares, but rather just have to maintain the area in "good agricultural and environmental condition" (EC, 2003). Hence, payments under the SPS are clearly decoupled from production decisions, but since land is necessary to activate entitlements they are not decoupled from land.

Based on different theoretical models, Ciaian *et al*. (2008), Courleux *et al*. (2008) and Kilian and Salhofer (2008) all conclude that SPS payments will at least partly be capitalized into land values. Empirically, the effect of the SPS on land rental prices is investigated by Kilian *et al*. (2012) for Bavaria, O'Neill and Hanrahan (2013) for Ireland, Guastella *et al*. (2014b) for Italy, Guastella *et al*. (2014a) for all EU Member States and Michalek *et al*. (2014) for all EU-15 Member States. While Kilian *et al*. (2012), O'Neill and Hanrahan (2013) and Guastella *et al*. (2014) find clear evidence that a considerable share of the payments is capitalized into land rental prices, Michalek *et al*. (2014) find much lower evidence and Guastella *et al*. (2014b) reject the hypothesis of a significant capitalization of SPS payments.

In explicitly modelling the policy change from coupled area and animal payments before the Fischler Reform to SPS payments afterwards, Kilian *et al*. (2012) conclude that one can expect the degree of capitalization to increase with the reform. This is mainly the case because animal payments were only loosely linked to land before the reform, e.g. through stocking limits, but are now integrated in the much closer linked SPS payments. Kilian *et al*. (2012) also provide some empirical evidence for this additional capitalization effect.

EU Member States were also given choices on how to implement the SPS. They could choose an historical model (initially distributed entitlement values were based on the farm's payment history), a regional model (all entitlements within a region have the same value which is based on the regional payment history), or a hybrid model (a combination of the historical and the regional model). The hybrid model exists in a static and a dynamic form. The latter proceeds in a stepwise fashion to the regional model. The historical SPS implementation model was chosen by Austria, Belgium, France, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Wales and Scotland. Malta and Slovenia chose the regional model. The static hybrid model was chosen by Luxemburg, Sweden and Northern Ireland, while Denmark, Finland, England and Germany chose the dynamic hybrid model.[1] Ciaian *et al*. (2008, 2014), Kilian and Salhofer (2008) and Kilian *et al*. (2012) show theoretically that the capitalization effect will be stronger in case of the regional model, as compared to the historical model. The main argument is that rental prices are determined at the margin. If high and low entitlement values exist, as in the case of the historical model, and owners of these entitlements compete for the same eligible hectares, the maximum willingness to pay of the low entitlement owner will determine the rental price in the market (Kilian *et al*., 2013, p. 792; Michalek *et al*., 2014, p. 265). Entitlement values in the regional model are uniform and therefore higher at the margin. We explain this in more detail in the next section. Another

argument as to why the capitalization is smaller with the historical model is the asymmetric information structure. In the case of the regional model, entitlement values that active farmers own are perfectly known to landowners, while this is not the case with the historical model. This may weaken the bargaining position of the landowner and decrease the rental price (Ciaian *et al.*, 2014, p. 654).

The 2013 CAP reform mandates the harmonization of decoupled payments within each country so all Member States achieve a regional model by 2019 (EU, 2013). This is where our analysis starts. Our primary hypothesis is that as the implementation model moves from an historical to regional payment scheme the capitalization effect increases. Since Germany chose the dynamic hybrid model we have a natural experiment for this transition from farm specific to regionally uniform entitlement values available. In particular, we use a rich farm level panel data set from the State of Bavaria for the years 2005 through 2011. To our knowledge, no one has empirically investigated how the SPS impacts rental prices as the regionalization of payments evolves. Our results confirm existing theoretical results and show that capitalization rates become larger as the transition to a regional model evolves.

The next section describes the land market and SPS regulations in Bavaria. Section 3 discusses why the capitalization effect will be stronger in the regional model and the differences between the former SPS and the new payment scheme introduced in 2015. Section 4 discusses the empirical model used to test our key hypothesis. Section 5 describes the utilized data, while section 6 presents our empirical findings. In the last section we provide some concluding remarks.

2. The Agricultural Land Rental Market and SPS Payments in Bavaria

In the typical agricultural land rental agreement in Germany, the one who farms the land (tenant) pays the cash rent as well as some contract-specific expenses (von Witzke *et al.*,

2007). The tenant receives the SPS payment (entitlement) plus market revenues. Unlike many other EU countries, the land rental market in Germany is quite liberal with no regulations in regard to contract duration and rental prices. In fact, a contract can have any duration or be open-ended. In the latter case the contract can be terminated without a specific reason either by the landlord or the tenant after an appropriate notice period. In contrast, Ciaian *et al*. (2010) report that the minimum legal contract duration is nine years in Belgium and France, six years in the Netherlands and five years in Spain. Looking at data for the period 2006 to 2008 Salhofer *et al*. (2009, pp. 39-40) find that contract duration in Germany varies considerably. One third of the contracts is open-ended. For the rest, they find several peaks in the distribution of contract duration: Short-term contracts with one year, medium-term contracts with five to six years, and long-term contracts with 9 to 12 years. For Southern Germany they find medium-term contracts to be typical but not exclusively.

For the last 20 years average agricultural land rental shares in Germany, defined as the rented agricultural area in total utilized agricultural area, have been relatively stable and somewhat above 60 percent (Figure 1).[2] With approximately 1.5 million hectares in 2013, Bavaria is the federal state with the most rented agricultural area in absolute terms. While average rental shares in Bavaria are smaller than in most other federal states, they are still considerable. Rental shares in Bavaria increased from 16.5 percent at the beginning of the 70s to 49.3 percent in 2013. We observe a constant increase until the beginning of this century, a relatively stable phase for the first years of the 2003 Fischler Reform, and an increase again in the last years. In contrast, average rental prices more than doubled between the beginning of the 70s and end of the 80s, remained fairly stable around 230 €/ha in the 90s and the first half of this century, but increased by 23 percent between 2007 and 2013. The rapid increase in rental prices in the last few years becomes even more obvious if we look at average rental prices of newly established contracts in Figure 2. In the last eight years rental prices of newly

established contracts increased by 73 percent for cropland and 70 percent for grassland. Given this, farm expenditures for land rentals are considerable and add up to € 2.05 billion for Germany and € 358 million for Bavaria in 2010. This is more than 30 percent of the net added value, defined as the production value minus input costs (not including rents) minus depreciation and direct payments.

The hybrid model of the SPS was introduced in Germany beginning January 2005. Entitlement values were based on a regional and a historical (farm specific) component (BMVEL, 2006). The latter, called top-ups, were based on different animal payments (special bull premium, calves slaughter premium, suckler cow premium, ewe premium, 50 percent of extensification premium), the dairy premium as allocated in 2005 and some payments for special products (25 percent of the decoupled part of the starch potatoes premium, decoupled part of dried fodder production aid, decoupled part of tobacco aid, sugar compensation payments) farms received on average between 2000 and 2002. The regional part of the payments was different between cropland and grassland. It also varied among federal states, but not among farms in the same state. For Bavaria 299 €/ha were assigned to cropland. This value was defined by summing up average payments between 2000 and 2002 mainly for arable area and some other support schemes (75 percent of the decoupled part of the potato starch potatoes premium, seed production aid, hop premium, payments for protein crops) in Bavaria and dividing it by the number of eligible cropland in 2005 (StLF, 2004). Similarly, a value of 89 €/ha was designed for grassland by summing up the following payments in 2002: slaughter premium for bovine (other than calves), 50 percent of extensification payments, complementary national bovine premium.

In 2005 each active farmer received as many entitlements as hectares farmed at that time. Entitlement values were determined by the land type (299 €/ha for cropland, 89 €/ha for grassland) and by the proportionate farm-specific payments (all attributable payments divided

by the hectares farmed). Therefore, entitlement values considerably varied among farmers, but each farmer's entitlements had the same value for each type of land. Average entitlement values in Bavaria in 2005 were around € 400 for cropland and € 244 for grassland (Salhofer *et al*., 2009).

Starting in 2010 all individual entitlement values were gradually transformed to a uniform value of € 354.55 in 2013. The transformation was progressive. For example, if a farmer owned an entitlement with a value of € 500 in 2009, it was decreased by € 144.46 over the next 4 years. In 2010 the value was decreased by 10 percent (€ 14.45), in 2011 by 20 percent (€ 28.89), in 2012 by 30 percent (€ 43.34) and 2013 by 40 percent (€ 57.78). If the initial entitlement value was less than € 354.55 it was gradually increased.

3. Theoretical Considerations

We demonstrate why the capitalization effect under the SPS will be stronger in the regional model with an example. Accordingly, we separate landowners from entitlement holders and assume a region consists of two landowners with one hectare of land each, and three active farmers who received one entitlement each but do not own any land.[3] Let's start with the regional model with all entitlements qualifying for the same amount of payments *E*. This example illustrates a situation where the number of entitlements in a region is larger than the eligible area. The three farmers holding the three entitlements need to rent one hectare of land each, otherwise their entitlements are worthless. Let's assume that the entitlement holders bid against each other for the two available units of land. Their maximum willingness-to-pay for the land will be the land rent (R_A) which can be realized by farming the land plus the payments related to the entitlement (E) (or marginally less).[4] As long as the price is lower than $R_A + E$, one of the entitlement holders has an incentive to raise his bid. Hence, the payments are fully capitalized into the rental price and transferred to the landowner.[5]

Let's now move to the situation of the historical model with different entitlement values for each farm. Assuming that the overall payments are the same as in the case of the regional model, let's distribute three entitlements with the following values: *4/3E, E, 2/3E*. With three entitlement holders bidding for the two hectares, the auction will stop at R_A + *2/3E* since the third farmer cannot offer a price above this value. Hence, the rental price of land is determined by the land rent and the value of the entitlement at the margin. There is no capitalization for any entitlement values above *2/3E* (Kilian *et al*., 2013; Michalek *et al*., 2014). Holders of entitlements with values *E* and *4/3E* will realize rents of *1/3E* and *2/3E,* respectively. This is the difference to the case of the regional model with full capitalization. Some parts of the payments will create rents for active farmers.

The situation is different where the number of entitlements is smaller than eligible hectares. Let's assume that a region consists of three landowners with 1 hectare of land each and two active farmers with one entitlement each. No matter if the entitlements have the same face value (*E*) or different face values (*4/3E, 2/3E*), as soon as the entitlement holders offer R_A (or marginally more) the landowners should accept. In this case, the payments are capitalized into the entitlement and not the rental price (Ciaian *et al*., 2008; Courleux *et al*., 2008; Kilian and Salhofer, 2008).

However, the exact ratio between entitlements and eligible area is not known since the eligible area is not a fixed magnitude and the number of entitlements can change over time. In principle, all land which is used primarily for agricultural production or was used before the introduction of the reform and is now kept in "good agricultural conditions" can be eligible area (BMVEL, 2006, p. 27). In the regional model and the hybrid model the initially distributed entitlements were equal to the utilized agricultural area plus land in good agricultural conditions with some exceptions (e.g. permanent crop land in Germany). Therefore, the number of entitlements should be approximately equal to the eligible area.

This is not true for the historical model where entitlements were distributed to farms which received payments between 2000 and 2002. This is confirmed by Ciaian *et al* (2014, Table 2) who show that for most countries with the regional or the hybrid model (Denmark, Germany, Finland, Luxembourg, Northern Ireland, Slovenia, Sweden) the ratio between activated entitlements and utilized agricultural area in 2007 (2009, 2011) was close to 100 percent, while it was significantly lower in most countries with the historical model (Austria, Belgium, France, Italy, Netherlands, Portugal, Spain). Similar results are reported in Ciaian *et al*. (2010, Figure 23) for a smaller number of countries and the years 2006 and 2007. In a very detailed analysis of this matter for Germany Salhofer *et al*. (2009) calculate the number of entitlements to be slightly larger than the eligible area at the starting point of the reform. There are some arguments why over time the ratio of entitlements to eligible area may increase. First, eligible area will decrease over time because of demand for agricultural land for other purposes. Second, new and young farmers who did initially not receive any entitlements, e.g. because they did not farm in the reference year, could apply for entitlements from the national reserve. Hence, for Germany it is reasonable to assume that the number of entitlements is close to or even larger than the eligible area.

The 2013 Reform of the CAP replaced the SPS with the Basic Payment Scheme (BPS) which came into effect in 2015. In the BPS decoupled payments have been divided into basic payments and some additional payments, including green direct payments, redistributive payments, payments for areas with natural or other specific constraints, and payments for young farmers. Receiving BPS payments follows the same rules as SPS payments before the reform. Farmers were allocated entitlements and need the same number of eligible hectares to active payments each year. Green payments account for 30 percent of all direct payments and are paid on the condition that farmers undertake practices that are beneficial to the climate and to the environment. Other additional payments are either linked

to farm and farmer characteristics. For all these payments, receiving BPS payments is a precondition. Thus, BPS and related other payments are linked to land in the same way as SPS payments before the reform.

4. Empirical Model

We model the rental price as a reduced form equation:

$$r_{it1} = \boldsymbol{x}_{it1}\boldsymbol{\beta}_1 + c_{i1} + u_{it1}, \quad t \quad 1 \ldots T \tag{1}$$

where, r_{it1} is the observed average rental price of farm *i* in time *t*, $\boldsymbol{x_{it1}}$ is a vector of explanatory variables including payments, other relevant covariates and $t - 1$ time dummies to account for year-to-year changes that are constant over individuals, e.g. expectations about output prices, c_{i1} accounts for unobserved farm heterogeneity, u_{it1} is an idiosyncratic error term and $\boldsymbol{\beta}_1$ is a vector of coefficients to be estimated. To estimate equation (1) we can use only those farms in the sample which actually rent land. Hence, we face an incidental truncation problem which may lead to a sample selection bias (Gronau, 1974). To account for the nonrandom nature of the sample, we need to understand why some farms chose not to rent. This decision may be due to things other than those which determine rental prices. Likely factors include characteristics such as, age, gender, and educational level of the farmer. In our rental price model, unless the decision to rent is fully explained by the observable variables or the inclusion of fixed effects, we need the nature of this decision to aid correction for potential bias.

To ensure consistent estimates when sample selection is potentially present, Heckman (1976, 1979) suggests a two-step procedure. In the first step the entire sample is used to estimate the decision to rent as a binary probit selection equation. In the second stage, the

researcher corrects for self-selection by incorporating a transformation of the predicted individual probabilities of the first stage, i.e. the inverse Mills ration (IMR), as an additional explanatory variable. The so called Heckit model accounts for the selection bias in the case of cross-section data under the assumption of no unobserved effects. The extension of the Heckit model to panel data and an unobserved effects framework is not straightforward, at least for small and fixed *T*, because of the "incidental parameters problem" (Neyman and Scott, 1948; Lancaster, 2000). Wooldridge (1995, 2002) suggested an unobserved effects extension of the standard Heckman (1976, 1979) model based on Mundlak's (1978) version of Chamberlain's (1980, 1982) approach to panel data model. The first stage involves estimation of binary probit models of s_{i2} for each of the t years.

$$s_{it2} = 1[\boldsymbol{x}_{it}\boldsymbol{\beta}_2 + c_{i2} + u_{it2} > 0] \qquad u_{it2} \mid \boldsymbol{x}_i \sim N(0,1) \tag{2}$$

where, s_{it2} is an indicator variable taking value one if farm *i* is renting land in time *t* and zero otherwise, $\boldsymbol{x}_{it}$ is a vector of exogenous explanatory variables observed every period and including all variables in $\boldsymbol{x}_{it1}$ plus at least one more; hence $\boldsymbol{x}_{it1}$ is a strict subset of $\boldsymbol{x}_{it}$, c_{i2} accounts for unobserved farm heterogeneity, u_{it2} is a standard normal distributed error term and $\boldsymbol{\beta}_2$ is a vector of coefficients to be estimated. Following Mundlak (1978) unobserved heterogeneity is modelled by the means of explanatory variables $c_{i2} = \bar{\boldsymbol{x}}_i\boldsymbol{\pi}_2 + v_{i2}$, where $\bar{\boldsymbol{x}}_i$ is a vector of means of all $\boldsymbol{x}_{it}$ for firm *i* over all *t* years with $v_{i2} \mid \bar{\boldsymbol{x}}_i \sim N(0, \sigma_v^2)$, and $\boldsymbol{\pi}_2$ is a vector of coefficients to be estimated. From the *t* models we recover the IMR, $\hat{\boldsymbol{\lambda}}_{it2}$, for all *i* and *t*.

Using $\hat{\boldsymbol{\lambda}}_{it2}$ and the Mundlak (1978) approach we augment the primary rental price equation to obtain our final regression specification:

$$r_{it1} = \boldsymbol{x}_{it1}\boldsymbol{\beta}_1 + \bar{\boldsymbol{x}}_{i1}\boldsymbol{\pi}_1 + \gamma\hat{\boldsymbol{\lambda}}_{it2} + \gamma_2 d_2\hat{\boldsymbol{\lambda}}_{it2} + \cdots + \gamma_T d_T\hat{\boldsymbol{\lambda}}_{it2} + u_{it1}, \quad t = 1, 2 \ldots T \qquad (3)$$

where $\bar{\boldsymbol{x}}_{i1}$ is a vector of means of $\boldsymbol{x}_{it1}$ for firm *i* over all *t* years, d_t are time dummies, and $\boldsymbol{\pi}_1$ and all γs are coefficients to be estimated.

We test the null that selection is not important by using a joint F-test on gamma coefficients with clustered bootstrapped standard errors. A significant F value implies sample selection is important. We estimate two version of this model, one where SPS payments enter in a time-constant manner and a second where SPS payments are allowed to have a time-varying impact on rental rates.

5. Data

We use farm level panel data from the German State of Bavaria. Bavarian farm bookkeeping records provide the data, which serve as a basis for the EU's Farm Accountancy Data Network (FADN). The sample is stratified with respect to legal form, farm type (agriculture, viniculture, horticulture and forestry), farm size and geographical region. However, very small farms and part-time farms are underrepresented. The reporting period is the financial year which starts at 1 July and ends 30 June. Hereinafter, we refer to the financial year 2005/06 as the year 2005 since CAP payments are usually transferred at the end of the year. Our panel consists of 2,663 farms observed annually for each year from 2005 to 2011, the first seven years after the Fischler Reform. Of these farms, we observe 2,509 farms with rented land comprising a total of 17,261 individual farm-year observations. We exclude some observations with inexplicable values, e.g. rental prices greater than 3,000 €/ha.

Descriptive statistics of the data are provided in Table 1. Farms renting land paid on average over all years 263 €/ha and received SPS payments of 351 €/ha. In addition to the decoupled direct payments (renting) farmers received on average 60.84 (61.58) €/ha agr-

environmental payments and 38.55 (39.47) €/ha disadvantaged area payments. To account for the effect of the quality of land in rental prices we include returns to land per hectare, defined as revenues minus variable costs. In addition, land quality and profitability is correlated with what is grown. Therefore, we include the ratio of crops in total utilized agricultural area of a farm as well as the ratio of some cash-crops (wheat, corn, rapeseed, potatoes, sugar beet) in crop area. Other farm specific characteristics include milk density, farm size in hectares and the percentage of rented farmland. We also include some socio-economic attributes of the farmer and his family, in particular, age, percentage of family labor employed, level of employment, gender and education level of farmer as dummy variables.

The exogenous variables of the selection equation $\boldsymbol{x}_{it}$ are described in Table 1 plus 11 dummies to account for 12 different agricultural production area as defined by Wittmann (1983) and LfB (1984). The subset of exogenous variables of the rental price equation $\boldsymbol{x}_{it1}$ does not include socio-economic factors: age, percentage of family labor, dummy for part-time farming, gender and education level.

6. Results

Results from estimation of the Wooldridge (1995) panel selection model are reported in Table 2 where the first column is for a model with time-constant SPS payment effects and the second column examines time variation in those effects on rental rates. We find very little evidence of selection bias as reported by insignificant IMRs. A significant coefficient on SPS payments suggests that policy support is an important determinant of rental prices.
The estimated coefficient .38 is highly significant (p-value < 0.000). It can be interpreted as the marginal impact on rental price resulting from an additional euro of SPS payment. The larger this coefficient the more the tenant pays, and the more is captured by the landlord.

Roughly 38 cents of the marginal single payment euro accrue to the landlord and 62 cents to the one who farms the land.

We further test the hypothesis that the capitalization effect becomes larger as the transition proceeds to a fully harmonized regional model. Our test is based on the time-varying SPS payment terms included in the second column of results. While the capitalization effect in the years 2006 to 2009 is not significant different form the first year, this is the case for the years 2011 and 2012. Clearly, a stronger capitalization effect has occurred during the first two years of the transition toward the regional model. As harmonization of the SPS occurs and the regional model takes-hold, the capitalization effect grows to 0.47 (0.361 + 0.106) in 2010 and 0.57 (0.361 + 0.212) in 2011. This result is strong empirical support for the hypothesis postulated by Ciaian, *et al*. (2008, 2014) and Kilian *et al*. (2012) that the capitalization effects are stronger under the regional model than the historical model.

All other covariates do have the expected signs and most of them are significant. Rental rates increase with increasing returns per hectare, with an increasing ratio of crop land and with an increasing rate of specific cash crops. A higher milk density may indicate lower land quality since most of milk farming in Bavaria takes place on pasture and at higher altitudes. The rental rate a specific farm pays decreases with farm size. This may explain the negative impact. A negative impact of farm size may indicate that small farms have higher economies of scale and therefore a higher willingness to pay for additional land. Though not significant, a higher rental rate may indicate higher financial pressure and therefore less possibilities to rent additional land.

Given the limited evidence for selection in the Wooldridge (1995) specification, we present robustness results for a fixed effects model in Table 3 with the same two specifications omitting area dummies which are absorbed by farm level fixed effects. This model is restricted to only farms observed as rentals. Our results, as expected, are

qualitatively quite similar to our previous findings with an approximate SPS capitalization increasing significantly only in the last two years, growing from 0.37 in 2005 to 0.53 in 2011. Overall, this model confirms our basic findings from the Wooldridge (1995) specification.

7. Concluding Remarks

By 2019 nine EU member states (Austria, Belgium, Denmark, Finland, Germany, Malta, Netherlands, Sweden, UK except Northern Ireland) will have implemented flat-rate entitlement values at the national or at least regional (e.g. England, Wales, Scotland in the UK) level (EP, 2015). The ten Member States applying the SAPS in the Fischler reform (Cyprus, Hungary, Lithuania, Slovakia, Latvia, Estonia, Romania, Bulgaria, Czech Republic, Poland) have decided to continue to apply this scheme until the end of 2020. Hence, they continue to have flat-rate area payments without entitlements. The rest of the countries (Belgium, Croatia, France (excluding Corsica), Greece, Italy, Luxembourg, Northern Ireland, Slovenia, Spain, Ireland, Portugal) will implement a partial convergence of the unit value of entitlements.[6] Hence, as intended by the last reform, there is a clear tendency to uniform payments per hectare within and across all EU member states. According to the theoretical work by Ciaian, *et al*. (2008, 2014), Kilian and Salhofer (2008) and Kilian *et al*. (2012) this may cause a higher capitalization effect.

We bring micro-level evidence of Bavarian farms to test the research hypothesis that the harmonization of SPS payments increases the capitalization into farm rental rates. Our data partly covered the period during which Germany converged from farm-individual to flat-rate entitlement values at the Federal Land level. This enabled us to estimate the time-related capitalization effects. Based on panel data models, we found weak evidence of sample selection, but strong SPS capitalization effects. On average, we found the marginal SPS payment to increase rental rates from about 0.37 cents but increased to 0.57 as Germany

transitioned to the harmonized payment result of the regional model. As EU member states move toward harmonized payments, the owner of the land can be expected to capture a greater portion of the SPS.

There are few comparable empirical studies that provide a perspective for our SPS capitalization estimates. However, to our knowledge none considered the effects of harmonization of payments. O'Neill and Hanrahan (2013) use a dynamic panel model and a farm level data set and estimate a capitalization effect of 21 to 53 Cents per Euro SPS payment for different farming systems (e.g., dairying, cattle, sheep, ….). Michalek et al. (2014) use a generalized propensity score matching approach and apply it to an extensive farm-level dataset that includes all EU Member States to find on average much lower average capitalization ratios between 0.04 (Greece) and 0.18 (Portugal). However, these capitalization ratios vary considerably between 0.033 and 0.94 for different payment levels and among different EU Member States. Based on a spatial econometric model and data aggregated at the NUTS II level (208 regions in EU-25), Guastella et al. (2014a) find that an additional 1 percent increase in SPS payments granted to farmers causes, on average, a 0.22 percent increase in farmland rents. On the other hand, Guastella *et al.* (2014b) used Italian data and found no effect of pre- and post-Fischler reform subsidies on rental rates. Comparable to our study they applied the Wooldridge (1995) procedure. It is quite possible that their differences are due to the Italian implementation model. Italy chose the historical model and Germany the hybrid model. As discussed in Ciaian *et al*. (2008), Courleux *et al*. (2008) and Kilian and Salhofer (2008) the degree of capitalization crucially depends on the ratio of the number of entitlements to the hectares of eligible area. Only if eligible area is scarce, a capitalization will take place. In implementing the regional or the hybrid model the number entitlements close to the number of eligible areas, since every hectare is assigned an entitlement. This is not necessarily the case in the historical model, if some hectares did not receive payments in

the base period. For example, for Italy Ciaian *et al.* (2014) report that the ratio of entitlements to UAA ranged only from 0.56 to 0.66 between 2007 and 2011. However, the number of entitlements that will be allocated to a farmer in 2015 under the new BPS will be based on the number of eligible hectares the farmer declares in either 2013 or 2015, whichever is less (EP; 2015). Hence, the number of entitlements will be approximately equal to the number of eligible hectares and we can expect a higher capitalization as payment values converge.

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Footnotes

[1] All New Member States except Slovenia and Malta have a Single Area Payment Scheme (SAPS) that we do not discuss here. Like in the regional model payments are the same for each hectare. However, farmers do not own tradable entitlements.

[2] Please note that 1991 is the first year with available data after the unification in 1989. Therefore, we do not depict the rental shares for Germany before that time.

[3] Note, that we do not necessarily have to assume this strict separation between landowners and farmers. Rather, the same would apply if we assume two farmers having n hectares of land and $n + 1$ entitlements or three farmers having m entitlements and $m - 1$ hectares of land. However, the strict separation makes the problem simpler and better illustrates the distribution of rents between landowners and active farmers.

[4] Here we argue in regard to the rental market, but the same reasoning is applicable to the sales market. In this case land rent R_A and the yearly entitlement value E are replaced by their discounted sum of expected values. In the case of land the time horizon may be infinite and the land value $V_A = e(R_A)/r$, where $e()$ is the expected value and r the discount rate. In the case of entitlements farmers have to form some expectation about their duration.

[5] The same reasoning is true if we look at the problem from the other side with the two land owners bidding for the three entitlements. In this case we would have to assume a Dutch auction where the three entitlement holders simultaneously offer their entitlement at continuously decreasing prices. Given that there are three entitlements offered and two bidders the final price for the entitlement will be zero (or marginally higher) and the land owner receive the rent of the entitlement. The value of the entitlements is zero.

[6] Under the partial convergence option, in 2019 basic payments will have to be such that no unit value of payment entitlement will be lower than 60 percent of the national, or regional, average by 2019. Payment entitlements with an initial unit value lower than 90 percent of

the national (or regional) average value will be increased by at least one third of the difference between their pre-convergence value and 90 percent of the national (or regional) average (EP, 2015).

Table 1. Summary statistics

	All Farms (N=18,641; Farms=2,663)				Farms Renting Land (N=17,261; Farms=2,509)			
	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
Rental Price (€/ha)					262,65	185,43	0,57	2983,86
SPS Payments (€/ha)	351,05	96,04	0,00	997,31	351,17	95,14	0,00	997,31
Disadv Payments (€/ha)	38,55	43,36	0,00	228,93	39,47	43,50	0,00	228,93
Agri-env. Payments (€/ha)	60,84	83,40	0,00	1683,66	61,58	82,36	0,00	1169,96
Returns (€/ha)	1366,45	921,75	-2069,30	8879,39	1351,98	873,50	-2069,30	8298,62
Crop Ratio	0,6538	0,3274	0,00	1,00	0,6520	0,3246	0,00	1,00
Corn Ratio	0,0378	0,1034	0,00	1,01	0,0372	0,1027	0,00	0,96
Sugar Ratio	0,0216	0,0580	0,00	0,85	0,0203	0,0546	0,00	0,49
Potatoes Ratio	0,0108	0,0500	0,00	0,57	0,0107	0,0493	0,00	0,57
Wheat Ratio	0,1571	0,1528	0,00	2,10	0,1547	0,1487	0,00	0,94
Rapeseed Ratio	0,0463	0,0795	0,00	0,90	0,0463	0,0781	0,00	0,90
Milk Density (100kg/ha)	28,9789	33,2065	0,00	204,63	29,6826	33,1052	0,00	204,63
ln(Utilized Agr. Area in ha)	3,8282	0,6163	1,63	6,08	3,8838	0,5909	2,03	6,08
Rental Ratio	0,4132	0,1902	-1,54	0,91	0,4178	0,1914	-1,54	0,91
ln(Age)	3,9768	0,1831	2,83	4,52	3,9741	0,1839	2,83	4,52
Family Labor (%)	0,9630	0,1036	0,18	1,00	0,9636	0,1019	0,21	1,00
Part Time	0,1069	0,3090	0	1	0,0933	0,2908	0	1
Female	0,0337	0,1804	0	1	0,0330	0,1785	0	1
Basic Agr. Education	0,5830	0,4931	0	1	0,5835	0,4930	0	1
Higher Agr. Education	0,3234	0,4678	0	1	0,3284	0,4697	0	1

Table 2. Wooldridge (95) panel selection

Variable	(1)	(2)		(1)	(2)
SPS Payments (€/ha)	0.3765***	0.3613***	Wheat Ratio	104.5944***	101.0167***
	(0.046)	(0.060)		(27.209)	(27.345)
Disadv Payments (€/ha)	0.7868***	0.7457***	Rapeseed Ratio	103.9821***	100.3775***
	(0.129)	(0.121)		(27.902)	(26.446)
Agri-env. Payments(€/ha)	0.0880***	0.0905***	Milk Density (100kg/ha)	-0.3658	-0.4225*
	(0.025)	(0.029)		(0.227)	(0.225)
SPS Payments - 2007 (€/ha)		0.0602	ln(Utilized Agr. Area in ha)	-88.6095***	-82.4259***
		(0.048)		(23.026)	(22.367)
SPS Payments - 2008 (€/ha)		0.0272	Rental Ratio	-4.6458	-5.6206
		(0.042)		(6.838)	(7.277)
SPS Payments - 2009 (€/ha)		0.0318	Inv Mills	53.5359*	45.6992
		(0.049)		(30.958)	(28.106)
SPS Payments - 2010 (€/ha)		0.0404	Inv Mills - 2007	-14.8942	-18.2683
		(0.049)		(32.629)	(28.581)
SPS Payments - 2011 (€/ha)		0.1055**	Inv Mills - 2008	-13.2445	-16.9489
		(0.051)		(35.753)	(32.884)
SPS Payments - 2012 (€/ha)		0.2119***	Inv Mills - 2009	-50.8453	-53.8818
		(0.067)		(45.518)	(41.050)
Returns (€/ha)	0.0149***	0.0139***	Inv Mills - 2010	-23.5794	-23.4705
	(0.004)	(0.004)		(45.080)	(42.141)
Crop Ratio	197.4797***	202.2264***	Inv Mills - 2011	-49.9309	-49.1801
	(57.298)	(54.765)		(34.606)	(32.772)
Corn Ratio	123.5503***	120.7670***	Inv Mills - 2012	-50.7920	-49.7944
	(30.736)	(30.958)		(36.584)	(36.562)
Sugar Ratio	281.6837	284.5438*	Constant	158.3147***	165.4805***
	(186.657)	(160.226)		(34.668)	(38.306)
Potatoes Ratio	129.7238	125.3393			
	(144.353)	(162.881)			
Mundlak (Panel) Means	YES	YES			
Year Fixed Effects (6)	YES	YES			
Area Fixed Effects (11)	YES	YES			
Observations	17,261	17,261			
R-squared	0.316	0.319			

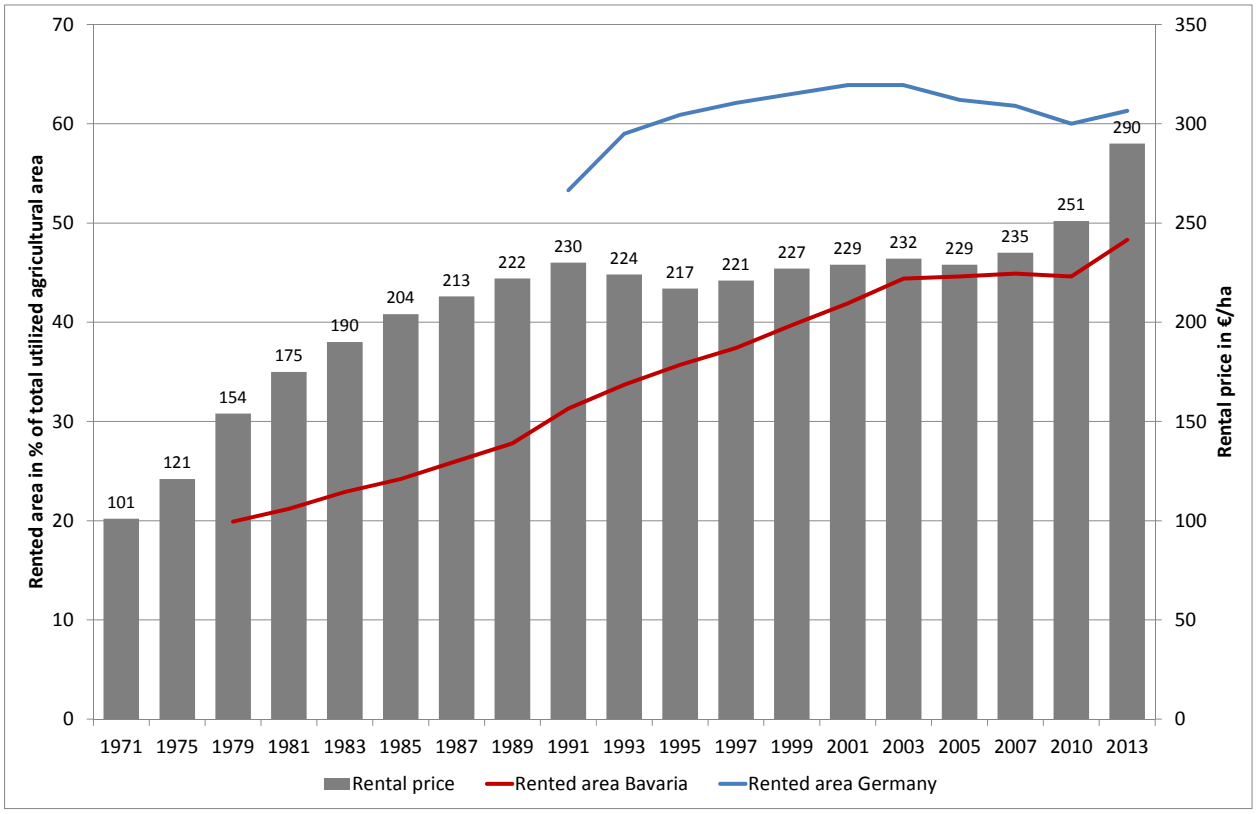
Bootstrapped clustered (farm) standard errors in parenthesis, * p<0.05, ** p<0.01, *** p<0.001

Table 3. Fixed effects OLS

Variable	(1)	(2)	Variable	(1)	(2)
SPS Payments (€/ha)	0.3700***	0.3658***	Potatoes Ratio	142.4050	136.8752
	(0.042)	(0.046)		(133.981)	(134.087)
Disadv Payments (€/ha)	0.7643***	0.7316***	Wheat Ratio	113.9281***	110.1793***
	(0.129)	(0.128)		(24.036)	(24.154)
Agri-env. Payments(€/ha)	0.0834***	0.0864***	Rapeseed Ratio	118.2225***	115.6025***
	(0.026)	(0.026)		(25.609)	(25.594)
SPS Payments - 2007 (€/ha)	---	0.0349	Milk Density (100kg/ha)	-0.2571	-0.3035
		(0.029)		(0.216)	(0.218)
SPS Payments - 2008 (€/ha)	---	0.0020	ln(Utilized Agr. Area in ha)	-120.9229***	-112.2089***
		(0.029)		(24.354)	(24.203)
SPS Payments - 2009 (€/ha)	---	0.0311	Rental Ratio	-4.4607	-5.2760
		(0.033)		(7.143)	(7.128)
SPS Payments - 2010 (€/ha)	---	0.0307	Year = 2007 (0/1)	-10.8093***	-23.1071**
		(0.035)		(3.056)	(9.900)
SPS Payments - 2011 (€/ha)	---	0.0760**	Year = 2008 (0/1)	-1.3278	-2.0734
		(0.034)		(3.955)	(10.090)
SPS Payments - 2012 (€/ha)	---	0.1639***	Year = 2009 (0/1)	4.8964	-6.3164
		(0.055)		(4.416)	(11.952)
Returns (€/ha)	0.0138***	0.0132***	Year = 2010 (0/1)	7.5248	-3.7422
	(0.003)	(0.003)		(4.606)	(12.269)
Crop Ratio	226.3089***	223.6082***	Year = 2011 (0/1)	9.0855**	-18.4668
	(59.155)	(57.992)		(4.285)	(12.392)
Corn Ratio	118.4587***	114.6807***	Year = 2012 (0/1)	18.9395***	-39.4833**
	(29.941)	(30.009)		(4.472)	(19.660)
Sugar Ratio	427.3463***	418.2100***	Constant	368.5665***	342.8346***
	(112.942)	(113.062)		(100.686)	(102.212)
Observations	17,261	17,261			
R-squared	0.072	0.073			

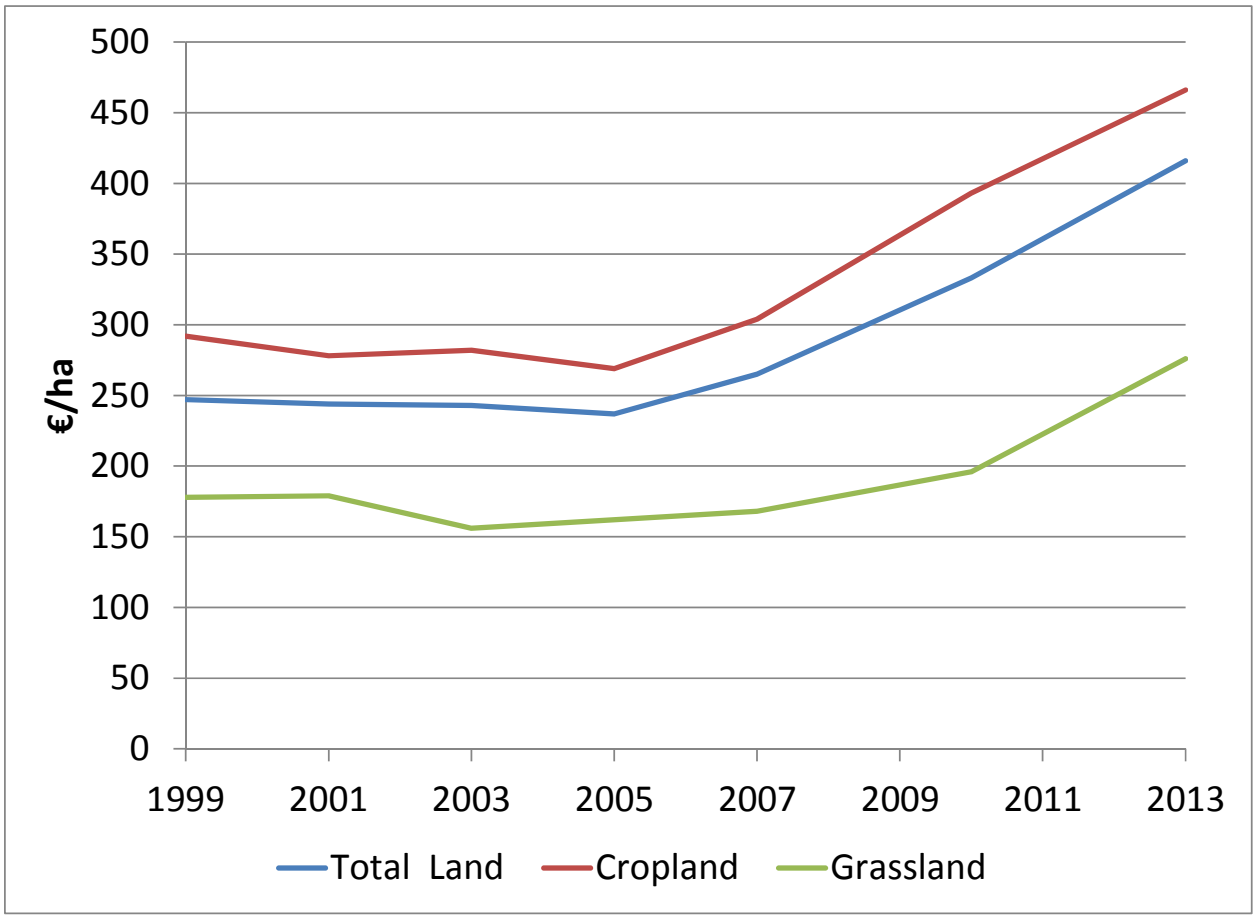
Clustered (farm) standard errors in parenthesis, * p<0.05, ** p<0.01, *** p<0.001

Figure 1: Percentage of rental area in Germany and Bavaria and average rental prices in Bavaria



Sources: own illustration based on StMELF (2014) and Agrarmanager (2014)

Figure 2: Average rental prices of newly established contracts



Sources: own illustration based on Agrarmanager (2014)

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