CAP IMPACTS ON LABOUR USE IN EAST GERMAN AGRICULTURE

Martin Petrick & Patrick Zier

petrick@iamo.de

Leibniz-Institut für Agrarentwicklung in Mittel- und Osteuropa (IAMO),
Halle (Saale), Germany

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Abstract

Our aim is to investigate whether the direct payments and rural development measures of the EU's Common Agricultural Policy (CAP) do make jobs in agriculture safer. We work with a dynamic labour demand equation that is augmented by the full set of policy instruments of the CAP. It is estimated on a unique regional panel dataset of three East German states for the period 1999-2006. We present results for three consistent estimators which differ in how they eliminate the fixed effects and how they instrument the lagged dependent variable, including estimators due to Arellano and Bond, Blundell and Bond, and a corrected least-squares dummy variable estimator due to Kiviet and Bruno. Our results suggest that there were few desirable effects on job maintenance or job creation in agriculture. While there is some indication that investment subsidies have halted labour shedding on farms, the introduction of the fully decoupled Single Farm Payment has likely contributed to significant job losses.

Keywords: Agricultural employment; Dynamic panel data models; Common Agricultural Policy; East Germany.

JEL-codes: Q18; J43; C23.

1 Introduction

Agricultural employment poses a dilemma for policy makers in Europe. On the one hand, agriculture's share in employment of all West European economies has been constantly declining for decades (TRACY 1993). On the other hand, many citizens expect that safeguarding jobs should be the top priority of government. Following this logic, politicians and farm lobbyists regularly claim that a protective agricultural policy is indispensable for keeping jobs in the first sector. Furthermore, it is argued that agriculture has much potential to also provide environmental services, contribute to quality of life in rural areas, and supply raw material for energy production. The "second pillar" instruments of the European Union's (EU) Common Agricultural Policy (CAP), such as investment aid, agro-environmental payments, and a broad range of rural development measures, are supposed to create employment via these additional functions (see, e.g., EC 2006). The aim of the present article is to investigate empirically whether the various CAP measures actually do make jobs in agriculture safer.

In the literature, sluggish labour adjustment in agriculture has been a long-standing issue. One prominent line of research has treated labour as a quasi-fix asset and studied interrelated factor demand functions in a framework of dynamic duality based on EPSTEIN and DENNY (1983). While the focus has more commonly been on capital, labour fixity has been investigated by several studies as well (VASAVADA and CHAMBERS, 1986; STEFANOU et al., 1992; PIETOLA and MYERS, 2000). These approaches establish a strong link between theory and estimation, but they have rarely been used to directly analyse policy effects on labour adjustment. Lacking data at the farm level may be one of the reasons for this neglect, however, it is also unclear how policy measures could be included in the dynamic duality formulation employed by these approaches. Recently, in studying capital investments, SCKOCKAI and MORO (2009) and SERRA et al. (2009) have made area payments an argument of the intertemporal utility function of the farmer. While this may be regarded a pragmatic solution, it is less clear how it could be extended to other policy measures. For example, several of the rural development measures are not even paid to farmers directly, but rather to local governments or downstream processors. Furthermore, if the analysis of policy effects moves to the centre of analysis, unobserved heterogeneity of beneficiaries and the endogeneity of programme participation becomes a core methodological problem (BESLEY and CASE, 2000; BLUNDELL and COSTA DIAS, 2009; HECKMAN and VYTLACIL, 2007). The use of panel data methods has proliferated in this area, however, the highly non-linear models in the tradition of intertemporal factor demand analysis have hardly been able to exploit the power of these methods.

In the following, our goal is to estimate policy effects on labour use in agriculture. Our workhorse is a dynamic labour demand equation that is augmented by the full set of policy instruments of the CAP. We estimate this on a unique regional panel dataset of the three East German States Brandenburg, Saxony, and Saxony-Anhalt. The slightly unbalanced dataset contains seven years of observations for 69 counties (*Landkreise*). Focusing on a single linearised equation allows us to make use of recent methodological advances in the analysis of dynamic panel data. Furthermore, by way of regional aggregation, we can consider the entire portfolio of first- and second-pillar measures simultaneously.

The main part of the paper considers a quantitative evaluation of policy effects that builds on current methods for estimating dynamic panel data models with fixed effects. We provide results of a least-squares dummy variable (LSDV) model with a first order autoregressive lag as a naïve reference model. This model is known to give biased results but has the general property of producing small standard errors. There is an ongoing discussion which alternative performs best in samples of a moderate number of cross-sectional units, N, and a small number of periods, T. We present results for three consistent estimators which differ in how they eliminate the fixed effects and how they instrument the lagged dependent variable. We consider estimators due to ARELLANO and BOND (1991), BLUNDELL and BOND (1998), and a corrected LSDV estimator due to KIVIET (1995) and BRUNO (2005a). Our results suggest that there were few desirable effects on job maintenance or job creation in agriculture. While there is some indication that investment subsidies have halted labour shedding on farms, the introduction of the fully decoupled Single Farm Payment (SFP) has likely contributed to significant job losses.

2 The CAP in East Germany and hypotheses about its effects on labour use

While farm structures are regarded as internationally competitive, politicians in the East German *Länder* place much hope on the ability of agriculture to provide additional services and create new jobs, beyond their traditional role of producing food and fibre.[1] As a result of Agenda 2000 and Mid-term review reforms of the CAP, East German *Länder* have been spending about two thirds of their CAP budget on direct payments, of which 75 percent are co-financed by the EU. The Single Farm Payment (SFP) was implemented in 2005. In addition, East German States implemented a region-specific mix of second pillar measures. The emphasis is on instruments under the umbrella of “development of rural areas”. These are mostly related to infrastructure investments, such as road construction and improvement, and are usually disbursed to local municipalities. The second largest portion of the second pillar measures goes to agro-environmental measures, which include payments for the maintenance of extensive grassland and the conversion to organic farming. In addition, some ten to twenty million euro are spent on compensatory allowances for less favoured areas (LFA), as well as on investment aids and processing and marketing support. While the former represents support for regions with below average soil conditions, the latter two are credit subsidies for a wide range of capital investments on farms and in the downstream sector.

We hypothesise the following effects of these policy measures:

[1] This is documented in various policy statements at the state level, for example in the Agricultural Report of the Land Brandenburg (MINISTERIUM FÜR LÄNDLICHE ENTWICKLUNG, UMWELT UND VERBRAUCHERSCHUTZ DES LANDES BRANDENBURG (MLUV) 2008).

1. Direct payments coupled to certain production activities, such as field crops or livestock rearing, will induce additional employment if more workers are required to maintain these activities. However, as payments were no longer coupled to the level of output generated already in the beginning of the period observed here, allocation effects will be small. Direct payments and payments for less-favoured areas will have no effect on labour use if they are fully decoupled.[2] A shift from a coupled to a decoupled policy regime, as implied by the CAP reform implemented in 2005, will therefore tend to release employment.
2. Most of the public goods investments, both for "rural development" or "processing and marketing", can be assumed to generate higher output prices (if only by reducing transaction or transport cost) and thus tend to increase labour use. Some may also reduce adjustment costs by making it easier to hire or release labour, and thus also increase equilibrium labour use.
3. Capital subsidies will reduce labour demand if labour and capital are substitutes, but will induce it if they are complements.
4. Agri-environmental payments are linked to certain types of output which generate positive environmental externalities (for example, protection of biodiversity or a certain landscape, or reduced soil erosion). They hence make the production of these outputs economically more attractive. If these outputs are produced by using a more labour-intensive technology than conventional outputs, they will increase labour demand.

It is hence not unfounded to expect that agricultural policies may have positive effects on agricultural employment, although effects of different policy packages may be of opposite direction. What the effects are in reality is an empirical question that is addressed next.

3 Empirical strategy

3.1 Deriving an estimating equation

Our approach is to analyse policy effects on long-term labour equilibrium by focusing on a single dynamic labour equation. As the impact on agricultural employment may vary substantially among policy measures and may even be of opposite sign, we argue that it is necessary to analyse their influence simultaneously. Several of the policy measures are not directly paid to agricultural firms, in particular, processing and marketing as well as rural development funds. However, annual payment streams disaggregated by measures are available at the regional (*Landkreis*) level. We therefore conduct the analysis at this level and assume that the model applies to a regionally representative farm. As we linearise the model below, it can be regarded as a consistent aggregation of individual farms.

We postulate that optimal employment is determined by the following set of factors:

$$(1) \qquad L_{jt}{*} = G\left(\theta_{jt}, p_{jt}, \tilde{Z}_{jt}, \bar{Z}_{j}\right),$$

where $L_{jt}*$ is the projected long-term agricultural employment in region j at time t, θ_{jt} is a vector of policy expenses that vary across regions and periods, p_{jt} is a vector of regionalised input and output prices at time t, $\tilde{Z}_{jt}$ is a vector of regional characteristics that also vary

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[2] It has been argued that they may increase factor use via wealth and insurance effects (HENNESSY 1998). SCKOKAI and MORO (2009) have shown recently for Italy that the risk-related effect of direct payments is small.

across time and space, and $\overline{Z}_j$ a vector of time-invariant regional characteristics, including land endowments. Such an equation can be motivated by a neoclassical dynamic labour demand model, such as discussed in HAMERMESH (1993, chapter 6).

Actual labour adjustment to optimal labour is sluggish, for example due to the presence of convex adjustment costs, and governed by a coefficient of adjustment $0 \le \gamma \le 1$ in discrete time as follows:

(2) $$L_t - L_{t-1} = \gamma(L_t * - L_{t-1}).$$

Solving (2) for L_t and inserting (1) yields an estimable reduced-form equation of L_t. Linearising this equation gives the following expression:

(3) $$L_{jt} = \lambda L_{jt-1} + \beta_1 \theta_{jt} + \beta_2 p_{jt} + \beta_3 \widetilde{Z}_{jt} + \beta_4 \overline{Z}_j + \varepsilon_{jt},$$

where β_i and λ are parameter vectors to be estimated and ε_{jt} is an identically and independently distributed error term. Note that this partial adjustment model provides an estimate of the coefficient of adjustment, as $\gamma = 1 - \lambda$. Concerning the effects of policy measures on labour demand, short-run and long-run effects have to be distinguished. Policies may affect current labour demand immediately, as measured by β_1. However, there is also a long-term effect via the dynamic adjustment process. In the steady state, $L_{jt} = L_{jt-1}$. Substituting this into eq. (3) and solving for L_{jt} leads to the long-run effect of θ_{jt}, which is $\frac{\beta_1}{(1-\lambda)} = \frac{\beta_1}{\gamma}$. The smaller γ, the slower is the adjustment of y to a new equilibrium and the bigger the effect of θ_{jt} that can only be observed in the long-run. If $\gamma = 1$ (or $\lambda = 0$), adjustment to the steady state is immediate and there is no sluggish adjustment at all. In this case, there is no effect that only occurs in the long-run. The model is transformed into a static model.

In the following, we wish to estimate (3) by using our East German county level data set in order to identify effects of the elements of θ_{jt} on L_{jt}. This is subject to two major methodological challenges. The first is the role of unobserved time-varying variables that may have an effect on regional policy expenses, as discussed in the literature on empirical incidence analysis that exploits variations in regional policies (BESLEY and CASE 2000; SMITH 2004). The second is the endogeneity of the lagged dependent variable, as discussed in the literature on dynamic panel data models (BALTAGI, 2008, chapter 8; CAMERON and TRIVEDI, 2005, 763-768).

3.2 Endogeneity of policy variables

Simply regressing observed employment figures on a set of regional characteristics and policy expenses will lead to biased estimates if not all relevant characteristics, which serve as control variables, can be observed. While some of these variables are routinely published by statistical agencies, such as land resources or climatic conditions, others are unlikely to be easily recorded, such as regional human or social capital. This approach, called ‘selection on observables’ (SMITH 2004, 297), will lead to spurious policy effects if such variables are omitted.

However, utilising the panel structure of the data provides a remedy for this problem. If the effects of time-invariant characteristics can indeed be linearly separated, regional fixed-effects will eliminate the bias originating from observed and unobserved heterogeneity, thus allowing for 'selection on unobservables' (SMITH 2004, 304). Forming first differences of (3) leads to:

(4) $$L_{jt} - L_{jt-1} = \lambda\left(L_{jt-1} - L_{jt-2}\right) + \sum_i \beta_i \left(x_{ijt} - x_{ijt-1}\right) + \varepsilon_{jt} - \varepsilon_{jt_0},$$

where x_{ijt} denotes the *i*-th time-varying right-hand variable in (3). This equation shows that the influence of observed and latent characteristics of regions, as far as they are time invariant, as well as any other linear separable selection bias is 'swept out' of the equation. However, because L_{jt-1} is correlated with ε_{jt-1} from eq. (3), $L_{jt-1} - L_{jt-2}$ will be correlated with $\varepsilon_{jt} - \varepsilon_{jt-1}$ in eq. (4) (CAMERON and TRIVEDI, 2005, 765). This latter problem will be addressed in the next section.

As noted by BESLEY and CASE (2000), a critical assumption in the estimation of equations like (3) is that the specification does not leave out any time-*varying*, region-specific variables that may have an influence on both θ_{jt} and L_{jt}. This assumption must be fulfilled for all of the estimators discussed before. We therefore briefly discuss the potential for policy endogeneity in our regressions. Clearly exogenous determinants of payment streams include price and subsidy levels as well as land endowments. All of these are likely to be either constant across regions (output prices and most factor prices and subsidy levels) or state-specific but time invariant (land resources). The former will be captured by a set of year dummies which are added to the estimating equation, the latter by regional fixed effects. Furthermore, transfers that are not paid on the basis of voluntary participation of farmers, such as public good investments or measures affecting the downstream sector are exogenous to the model per se. The question is thus which variables remain in $\tilde{Z}_{jt}$ that cannot be controlled for by using fixed effects.

BESLEY and CASE (2000) emphasise the importance of regional political variables that may have a bearing on regional policy design. This determinant can be largely ruled out here, as the underlying political decisions are mostly made on a European level, with only some leverage left at the *Länder*, but not at the *Landkreis* level. Whereas the procedures for calculating and administrating direct payments are mostly settled at the European and national level, *Länder* have freedom to allocate funds within their Rural Development Plans (to be cofinanced from the EAGGF Guarantee section) and their Operational Programmes (in East Germany to be cofinanced from the EAGGF Guidance section) (SCHUBERT 2002). Regional programmes are thus focusing on agri-environment and farm structures, and state governments can decide how to use funds from the modulation of direct payments. However, there is practically no decision power related to the CAP at the *Landkreis* level, our unit of observation.

With regard to direct payments, critical variables in determining payment streams are which crops are planted and how many animals are kept in a given region. Similarly, the area under environmental-friendly practices or the farms' investment activities are determining the absorption of agri-environmental measures or capital subsidies. While these are decision variables of the farm managers and thus potentially endogenous, we maintain the assumption that there is an "average" potential of a region to absorb these payments. This potential is assumed to be completely determined by the given environmental conditions and human resources of that region. It can thus be eliminated by fixed effects. Changes in this potential over time are neglected.

Two variables that plausibly do vary across regions are the prices of labour as well as the local demographic structure. Labour markets are typically local because of the inherent immobility of these factors. In addition, net migration out of rural areas has been particularly strong in the age class between 18 and 29 years and may have led to local shortages of labour (UHLIG 2008). It also may have wider implications in terms of public goods provision by the government. We capture these trends by including variables on wages and regional population density.[3]

3.3 Endogeneity of the lagged dependent variable

Estimation of dynamic factor demand equations has been an active field of methodological research recently. The challenge has been to derive consistent estimators which are capable to eliminate fixed effects but nevertheless make efficient use of the data and perform well in samples of moderate size. As shown by NICKELL (1981), the traditionally employed least squares dummy variable (LSDV) approach to eliminate fixed effects in (3) will be inconsistent if T is small, because L_{jt-1} is endogenous. ANDERSON and HSIAO (1981) have suggested to eliminate fixed effects by first differencing and use L_{jt-2} in an equation like (4) to instrument $L_{jt-1} - L_{jt-2}$, as L_{jt-2} is uncorrelated with $\varepsilon_{jt} - \varepsilon_{jt-1}$. This approach yields consistent estimates if $N \to \infty$. ARELLANO and BOND (1991) improved the efficiency of the instrumental variables approach by using further lags of the lagged dependent variable in the framework of a Generalised Method of Moments (GMM) estimator. BLUNDELL and BOND (1998) showed that further efficiency gains are possible by also including lagged differences as instruments into a level equation of the dependent variable.

The former estimators are valid for large N and their properties in small sample sizes are generally not known. Analysts working with macro panels containing only a limited number of cross-sectional units have therefore argued that their usefulness for empirical work may be doubtful (JUDSON and OWEN, 1999). KIVIET (1995) has argued that the advantages of the LSDV approach in terms of efficiency could be combined with the consistency of the GMM estimators by using the latter for a correction of the former. Monte Carlo studies of small N and moderate T (for example $N = 100, T = 20$) by JUDSON and OWEN (1999) used the correction factor developed by KIVIET (1995) to estimate a “corrected LSDV”. They show that it outperformed the GMM approaches both in terms of bias and efficiency. BRUNO (2005a) extended the correction procedure for application in unbalanced panels.

4 Data

In the present application, we work with $N = 69$, whereby the panel is slightly unbalanced. There is generally a coverage of 7 years in the right-hand variables, but the period covered differs by one year, depending on the state (Table 1). Furthermore, the number of lags available for the dependent variable varies between states.

Table 1: Overview of data coverage

	Brandenburg (N=16)	*Saxony (N=29)*	*Saxony-Anhalt (N=24)*
Dependent variable	1994-2006 (T=13)	1996-2006 (T=11)	1994-2006 (T=13)
Right-hand variables	2000-2006 (T=7)	2000-2006 (T=7)	1999-2005 (T=7)

Source: Authors’ calculations.

[3] Data on land prices was not available with sufficient coverage to be included in the model.

Table 2: Descriptive statistics

		Mean	*Std. Dev.*	*Min*	*Max*	*N*
Brandenburg						
Employees 1st sector	n	2736	1267	227	5337	208
Direct hectare payments	Mln EUR	18.330	10.673	0.914	45.410	112
Direct livestock payments	Mln EUR	3.534	2.258	0.074	11.025	112
Development of rural areas	Mln EUR	4.149	3.134	0	17.412	112
Processing and marketing	Mln EUR	0.303	0.678	0	3.597	112
Investment aids	Mln EUR	0.879	0.648	0.001	3.286	112
Less favoured areas	Mln EUR	1.581	0.852	0.082	3.351	112
Agri-environment	Mln EUR	2.686	1.332	0.257	5.585	112
Population density	n/km²	146	171	41	764	112
Average annual wage all sectors	EUR	26.49	1.29	24.12	29.18	112
Saxony						
Employees 1st sector	n	1734	854	109	3825	319
Direct hectare payments	Mln EUR	8.593	6.194	0.022	22.790	203
Direct livestock payments	Mln EUR	1.013	0.757	0.016	3.930	203
Development of rural areas	Mln EUR	3.400	2.728	0	10.694	203
Processing and marketing	Mln EUR	0.375	2.202	0	24.298	203
Investment aids	Mln EUR	0.871	0.881	0	4.096	203
Less favoured areas	Mln EUR	0.559	0.694	0	3.088	203
Agri-environment	Mln EUR	1.653	2.449	0	11.886	203
Population density	n/km²	395	420	71	1696	203
Average annual wage all sectors	EUR	25.11	1.71	21.21	30.93	203
Saxony-Anhalt						
Employees 1st sector	n	1493	838	271	3924	312
Direct hectare payments	Mln EUR	14.071	9.109	0.500	41.109	168
Direct livestock payments	Mln EUR	0.846	1.087	0.021	7.003	168
Development of rural areas	Mln EUR	4.759	4.016	0	23.530	168
Processing and marketing [a]	Mln EUR	0.324	1.103	-0.779	12.914	168
Investment aids	Mln EUR	0.344	0.449	0	2.644	168
Less favoured areas	Mln EUR	0.239	0.454	0	2.068	168
Agri-environment	Mln EUR	1.019	1.032	0.049	4.860	168
Population density	n/km²	254	396	42	1912	168
Average annual wage all sectors	EUR	25.04	1.10	22.69	28.71	168

Note: [a] There was occasional overpayment in some regions, which led to negative expenses in subsequent years.

Source: Authors' calculations.

Given this data set-up, there is no unambiguous preference for one of the estimation approaches outlined before, except that the uncorrected LSDV is theoretically inconsistent. However, it is clear that our *N* is much smaller than in the typical applications of panel data methods to firm or household data covering several thousands of observations. As such, the corrected LSDV results may be regarded as most reliable among the four.

Data on CAP payments was collected from paying agencies of the state agricultural ministries for the periods given in Table 1. All other data was taken from official statistics (DESTATIS 2009). Descriptive statistics by state are given in Table 2.

5 Estimation results

In the following, we show results for four different fixed effects specifications of eq. (3). We estimated the LSDV with a first order autoregressive lag as a naïve reference model (Model A) along with two asymptotically consistent estimators which differ in their instrument set, the Arellano-Bond (model B) and the Blundell-Bond (model C) estimator. Furthermore, we present results for a corrected LSDV estimator due to KIVIET (1995) and BRUNO (2005a) (model D), by using the Arellano-Bond results for initialisation.[4]

In addition to the lagged employment variable, the equation contains the seven policy aggregates listed in Table 2. To analyse the effect of the Single Farm Payment (SFP), we add a dummy variable "Decoupling" which takes the value of one in 2005 and 2006, and zero before.[5] Furthermore, an average annual wage for all sectors, the regional population density, and year dummies for the period 2000-2004 are included.

In model (B), one cross section of observations is lost due to first differencing. Models (A) to (C) use cluster robust standard errors based on the county variable, which controls for both serial correlation and heteroscedasticity in model (A) (CAMERON and TRIVEDI 2005, 707). Models (B) and (C) report heteroscedasticity-robust standard errors and robust tests for serial correlation due to ARELLANO and BOND (1991). The tests present no evidence of second-order autocorrelation. Model (D) uses bootstrapped standard errors. The hypothesis that estimated parameters are all zero was clearly rejected in all models, as indicated by the *F*- and χ^2-statistics.

Comparing the p-values of models (B) to (D) in Table 3, there is no unambiguous ranking of estimators in terms of efficiency. Neither is the Blundell-Bond model clearly superior to the Arellano-Bond, nor does the corrected LSDV estimator outperform the other two.

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4 Estimations were carried out by using the routines xtreg, xtabond, and xtdpdsys implemented in Stata 11, as well as the user-written routine xtlsdvc due to BRUNO (2005b).

5 For 2005 and 2006, direct payments under the SFP were split into area and livestock payments according to the average distribution of the latter between 2000 and 2002, following official calculation rules (BMVEL, 2005).

Table 3: Regression estimates: policy impacts on employment in agriculture

	LSDV (A)			*Arellano-Bond (B)*			*Blundell-Bond (C)*			*Corrected LSDV using (B) (D)*		
Explanatory variables	*Coefficient*		*p-value*	*Coefficient*		*p-value*	*Coefficient*		*p-value*	*Coefficient*		*p-value*
Ag employment (lagged one year)	0.64	***	< 0.001	0.45	***	< 0.001	0.81	***	< 0.001	0.76	***	< 0.001
Direct hectare payments	-9.02		0.391	-15.61		0.176	12.88		0.136	-5.06		0.475
Direct livestock payments	4.01		0.788	-8.06		0.645	25.64		0.160	7.46		0.517
Development of rural areas	0.09		0.972	1.48		0.689	-4.71		0.416	0.05		0.988
Processing & marketing support	-6.38	**	0.029	-0.51		0.901	-1.56		0.696	-6.68		0.112
Investment aids	17.90	**	0.047	8.02		0.367	23.72	**	0.039	18.82		0.203
Less favoured areas	-6.24		0.906	-63.96		0.330	-29.49		0.498	-0.81		0.980
Agri-environmental scheme	1.73		0.614	5.72		0.222	-0.20		0.968	0.78		0.873
Decoupling (1999-2004=0; 2005/6=1)	-97.90		0.110	-151.77	**	0.025	-120.88	**	0.047	-71.50	*	0.082
Population density	-0.37		0.393	-1.40	**	0.036	0.13		0.637	-0.13		0.786
Average annual wage all sectors	-35.37	**	0.035	-47.81	*	0.071	4.53		0.506	-28.11		0.108
Number of instruments	--			71			79			71		
Number of observations	483			414			483			483		

Notes: All models include year dummies for 2000-2004 (parameters not reported). *** (**,*): significant at the 1% (5%, 10%) level.
Model (A): Includes dummy variables for 69 clusters. Adj. R^2 (overall)=0.934. F-value (16,68)=75.53. p-value<0.001. Standard errors adjusted for 69 clusters. Model
Model (B): Variables transformed into first differences. Lags of order two back to the maximum possible are used as GMM-type instruments for the lagged dependent variable using the one-step procedure. First differences of all right-hand variables used as standard instruments. Wald test of jointly zero coefficients χ^2 (16)=459.1. p-value<0.001. Arellano-Bond test for zero autocorrelation: p-value of order 1=0.021, p-value of order 2=0.219. Standard errors adjusted for 69 clusters.
Model (C): Variables transformed into first differences. Lags of order two back to the maximum possible are used as GMM-type instruments for the lagged dependent variable in the differenced equation using the one-step procedure. Lagged differences used as GMM-type instruments for the lagged dependent variable in the level equation. First differences of all right-hand variables used as standard instruments. Wald test of jointly zero coefficients χ^2 (16)=15503.7. p-value<0.001. Arellano-Bond test for zero autocorrelation: p-value of order 1<0.001, p-value of order 2=0.125. Standard errors adjusted for 69 clusters.
Model (D): Standard errors bootstrapped with 100 replications. Correction procedure is based on BRUNO (2005a, b).

Source: Authors' calculations.

Our interest focuses on the evidence concerning lagged adjustment and the effects of policy measures. All models consistently show that labour adjustment is sluggish, with a highly significant coefficient of adjustment. However, the reported levels differ considerably. While the LSDV result must be assessed with caution due to the inconsistency of the estimator, model (C) reports a considerably higher value than (B). This is in line with the finding of BLUNDELL and BOND (1998) that the Arellano-Bond estimator may be downward biased. The Blundell-Bond results are close to the corrected LSDV results, which implies that the coefficient of adjustment is at 24 percent. This means that, after a shock, it takes about two and a half years to move halfway to the new steady state.[6] This level of the adjustment coefficient is in the range of values found in other studies on dynamic labour adjustment, such as in STEFANOU et al. (1992) for German family farms and LUH and STEFANOU (1996) for US farms.

With regard to policy effects, a first conclusion to be drawn is that most measures had no significant impact on agricultural employment at all. There is weak evidence that processing and marketing aid reduces employment. However, the GMM models do not support this finding and also in the corrected LSDV the parameter does not pass the ten percent level of significance. A bit stronger is the evidence on positive employment effects of investment support, which is significant at five percent in the LSDV and the Blundell-Bond models. According to the latter, one million euro of investment aid per region creates almost 24 jobs in agriculture in the short run. For this short run effect, 42 thousand euro annually are required to create one additional job. Given the logic of our model, full adjustment to a new employment equilibrium takes time, so that the full effects are visible only in the long run. Using the adjustment coefficient of model (C), the long run effect is 125 jobs in the steady state per one additional million euro of investment aid paid now. However, this result is not borne out in the corrected LSDV model.

A result consistently supported by models (B) to (D) is that there were significant employment losses in the years 2005 and 2006. Our interpretation is that this is due to the introduction of the decoupled SFP. It is unlikely that a severe macro effect, such as price drop, caused this fall in employment, as the revenue and profit situation of farms in Germany had notably improved in 2005 compared to previous years (BMELV 2007, 17). According to our view, decoupling broke the link between payments and labour allocations necessary for the maintenance of certain farm activities. The estimates range from 72 to 152 agricultural jobs per region that were lost due to decoupling in the short run (Table 4). Mean employment in the first sector per region was 1893 persons in the observed period, so that the SFP on average implied losses of 4 to 8 percent of jobs in agriculture. In the long run, these effects are even more dramatic, ranging from 276 (model B) to 637 (model C) job losses due to decoupling, or up to one third of all jobs in agriculture.

Table 4: Average short- and long-run job losses per region due to the 2005/6 effect

	Arellano-Bond (B)	*Blundell-Bond (C)*	*Corrected LSDV (D)*
Short-run losses (persons)	-152	-121	-72
Long-run losses (persons)	-276	-637	-298

Source: Authors' calculations.

Models (A) and (B) also produced significant parameters on population density and the overall wage level. The negative signs imply that fewer people work on farm in regions which are more densely populated and where wages are higher, which is a plausible result.

6 The median length of the lag can be obtained by solving for t^* in $\lambda^{t^*} = 0.5$ (HAMERMESH 1993, 248), which is $t^* = \log_{\lambda} 0.5$.

6 Conclusions

Our regression analysis of CAP payments in three German States reveals that there were few desirable effects on job maintenance or job creation in agriculture. The results are based on four specifications of a dynamic employment equation with fixed effects estimated on county level data. The specifications differ in how they eliminate the fixed effects and how they deal with the endogeneity of the lagged dependent variable. We found that agricultural employment adjusts slowly to shocks. On average, it takes about two and a half years to move halfway to the new steady state. Direct payments for crops and livestock, measures for the development of rural areas, transfers to less favoured areas and agro-environmental measures had no employment effect at all. Processing and marketing support to the downstream sector implied job losses in one of the four specifications. There was a significant loss of jobs in agriculture in 2005 and 2006. We suspect that this may have been a consequence of decoupling. Due to this effect, in the long run, up to one third of agricultural jobs per region are at stake.

The evidence presented here suggests that the only way to actively promote job creation in the CAP framework is via capital subsidies. These subsidies are mostly used to finance buildings or machinery. Apparently these increases in capital use were sufficiently complementary to labour that they induced relatively higher employment, that is they slowed down labour cuts. According to our estimates, 42 thousand euro of subsidies are required annually to create one additional job in the short run. However, capital subsidies are more effective in the long run, as they also affect the steady state equilibrium labour demand. Furthermore, it should be stressed that this finding is supported by only two of the four econometric specifications.

We therefore conclude that, in the three East German States, the CAP mostly misses its target of safeguarding jobs. Potentially positive effects due to capital subsidies were counteracted by the recent decoupling of direct payments. Given the policy perspective to "modulate" further funds away from direct payments, this analysis calls into question whether an expansion of second pillar measures is a reasonable way to use the modulated funds.

The analysis here has focused on the goal of job creation in agriculture. With regard to other goals that may have been achieved by the CAP, such as environmental stewardship or the social goal of income redistribution, we can only conclude that their potential achievement at least has not made jobs in agriculture safer.

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