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Employment effects of CAP payments in the UK non-farm economy

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This paper investigates the effect of the CAP payments on the indirectly generated non-farm jobs and whether there are differences in the effect according to business location - rural or urban - and according to CAP measures, in particular Pillar 1 and Pillar 2. A microeconomic approach is employed, based on company data from FAME dataset combined with detailed subsidies data from DEFRA. The focus is on employment in small and medium-sized enterprises (SMEs), which are central for job creation. The generalised method of moments (GMM) is used to estimate the effect of CAP payments on both the level and growth of employment. The results suggest positive net spillovers of CAP payments to non-farm employment. Although the magnitude of the effect is small, it is economically significant. Relative to Pillar 2, Pillar 1 payments have a stronger positive effect. As expected, the non-farm employment effect is particularly important for rural SMEs.

Keywords: CAP, non-farm employment, SMEs, spillovers, rural-urban
JEL codes: D22, H25, J20, Q18, R11

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1 Introduction

This paper investigates the contribution, if any, of the EU's Common Agricultural Policy (CAP) payments to non-farm sector employment in both rural and urban areas in the UK through its direct and indirect effects on agriculture's up- and downstream industries, and the economic diversification of rural areas. In recent years, given the difficult recovery from the 2008 economic and financial crisis, the provision of employment is of primary interest to policy makers and to millions of UK citizens. Additionally, whatever the UK package for Brexit will be, it is almost certain that the UK will leave the CAP and the ways agriculture is supported will change. Naturally, majority of existing studies are concerned with the effects of the forthcoming changes on agriculture but it is also useful to have some indications of the possible benefits or losses beyond farming by investigating the inter-industry spillovers of the CAP payments on non-farm employment.

For decades, the CAP payments have tried to maintain the level of agricultural employment, or at least to slow down its decline as a result of technical and structural change. In the face of these forces, the CAP could hardly have further impact in the direction of job creation or even job maintenance in primary agriculture. However, the CAP payments may have inter-industry spillovers on non-farm employment which are often not-accounted for.

Against this backdrop, the objective of this paper is to estimate the effect of the CAP payments on the indirectly generated non-farm jobs. In particular, the study focuses on three key questions: (i) whether CAP payments are positively associated with non-farm

employment; (ii) whether there are differences in the effect according to business location - rural or urban; and (iii) whether different CAP payments have different employment effects, i.e. Pillar 1 direct payments and Pillar 2 rural development payments.

Most previous CAP and employment research has focused on the CAP's impact on agricultural and rural jobs, often in an EU regionalised framework (for example, Petrick and Zier, 2011; 2012; Olper *et al*., 2014). Other studies have addressed only the impact of rural development payments under Pillar 2 (e.g. Mattas *et al*., 2011). A recent report for the European Parliament Committee on Agriculture and Rural Development (COMAGRI) concerning the role of CAP in creation of rural jobs has reviewed 53 studies. All of these studies were agri-centred - they were either focused on agriculture and rural jobs, or on labour migration out of agriculture (EP, 2016). One notable exception is the paper by Blomquist and Nordin (2013), who employed a macroeconomic approach and estimated the open-economy relative multiplier of agricultural subsidies in Sweden, thus capturing the CAP's impact on employment beyond agriculture. The present paper tries to fill the gap in the literature and to stimulate a broader debate about the wider, inter-industry employment effects of the CAP.

The paper employs a micro approach, based on company data extracted from the Financial Analysis Made Easy (FAME) dataset of Bureau van Dijk combined with detailed subsidies data extracted from Department of Environment, Food and Rural Affairs (DEFRA) CAP Payments database. Only the effects on employment in small and medium-sized enterprises (SMEs) are analysed. SMEs are defined by the UK Government and the EU as businesses with less than 250 employees. The rationale to focus on SMEs is based on two considerations. First, at the beginning of 2013, SMEs represented over 99 per cent of all private-sector businesses in the UK, accounting for 59.3 per cent of private-sector employment and for 48.1 per cent of private-sector turnover (Department for Business Innovation and Skills, 2013). They are also central to job creation as recognised by the UK government. Second, as mentioned above, one of the objectives of the study is to investigate whether there are different effects of CAP payments on employment in rural and urban non-farm businesses. Rural businesses are mainly SMEs, and comparisons with large companies (national and international) located in metropolitan areas would be inconsistent.

The theoretical underpinning of the analysis is based on Smolny's (1998) monopolistic competition model with delays in adjustment in output price, employment, and capacity. The generalised method of moments (GMM) is used to estimate the effect of the CAP payments on both the level and the growth of employment. The results suggest positive

net spillovers of CAP payments, although the magnitude of coefficients is rather small. Looking at different CAP measures, relative to other CAP expenditure, Pillar 1 direct payments have a strong statistically significant effect on the level of employment but not on the employment growth. As expected, the CAP effect on employment is mostly concentrated in rural SMEs.

The rest of the paper is structured as follows. The next section presents a short overview of the CAP subsidies in the UK and their distribution by constituent country. Section 3 details the theoretical framework, and section 4 presents the data and the estimation strategy. Section 5 presents the results while section 6 concludes with a brief discussion of policy implications.

2 The evolution of CAP subsidies and the implications for employment

The period covered in the empirical analysis ranges from 2008, the year of the CAP Health Check by the European Commission, to 2014 - the first transitional year of the 'new' CAP for the period 2014-2020. The presentation of the implementation of different CAP measures in the UK is limited to the period analysed, since a wider general discussion of the CAP is beyond the scope of the present paper.

The Health Check of 2008 introduced the main policy changes before implementation of the most recent CAP reform for the period 2014-2020 (Allen *et al*., 2014). It did not change the fundamental decisions taken in the 2003 CAP reform, i.e. the introduction of a decoupled (from production) Single Farm Payment (SFP) to farmers, conditional on environmental and other cross-compliance requirements, and keeping the land in Good Agricultural and Environmental Conditions (GAEC), as the main feature of Pillar 1. The Health Check moved slightly further in the direction mapped by the 2003 CAP reform, i.e. it decreased the remaining coupled payments, increased modulation of funds from Pillar 1 to Pillar 2, and removed arable land set-aside. It also provided the EU Member States (MSs) with flexible possibilities to assist sub-sectors of agriculture with special problems, the so-called Article 68 measures.

From theoretical viewpoint, given existing legislation, the CAP payments can affect non-farm employment both through a production and a consumption effect. In the 2003 Council Regulations establishing the rules for direct support schemes, the SFP scheme was treated as income support (OJ, 21/10/2003). The SFP is paid to farmers, the latter defined as natural or legal persons, or groups of such persons. Although in theory decoupled, the SFP may be invested in farm production and thus increase or maintain the employment in

agriculture or up- and downstream industries. Bhaskar and Beghin (2007) reviewed a number of studies on the coupling mechanisms of decoupled payments. Some of these mechanisms include wealth and insurance effects that might increase the use of inputs and affect the increase in output; the effect on investment decisions as farmers could save and invest more; and increased liquidity of credit-constrained households.

The decoupled income support to farmers can also have a complex impact on the income-leisure trade-off and labour allocation decisions to work on- or off-farm. It might also increase savings and/or the contemporaneous consumption of farm households of non-farm goods and services as SFP adds to the overall household purchasing power. The effect in terms of farmers' household income/expenditure is generated mainly in rural areas but it may or may not correlate with increased employment in those areas, taking into account purchases at a distance and services provided from urban areas. Additionally, the increase of the overall purchasing power in rural areas depends on how much of the CAP payments remain with the farm households. Higher land rent, which is a well-known consequence of direct payments, leaks out to landowners who may not live in the locality. [1]

. To conclude, there are two main channels through which CAP SFP may affect non-agricultural employment – through its effect on consumption as a really decoupled payment, and through its coupled effect on farm investments and output level. Both these channels would lead to expansion in the demand that the non-farm sector firms face.

Concerning Rural Development (RD) measures in Pillar 2, there are a wide range of channels through which payments can affect non-farm employment. Rizov (2004) studied the effect of CAP on the organisation and performance of rural communities since the introduction of Pillar 2 in 1999. He developed a theoretical model of private provision of public goods where RD payments lead to diversification of the economic activities in rural areas which, in turn, enhances the sustainability of the local economy. While his focus is mainly on formally defining the conditions under which the CAP income transfers can improve, or otherwise, rural community development, he does not explicitly address the complementary employment effects. However, the RD measures may create employment both within the local rural community and beyond, in the urban areas, thus illustrating the

[1] A consequence of the appropriation of a high share of payments by the landowners means that the *local* multiplier effect of CAP Pillar 1 payments is likely to appear lower in those areas where there is a high proportion of rented land, as higher rents leak out to landowners who do not always live in the same locality; thus, the true effect is likely to be larger. Furthermore, while the presence of leakages is an important consideration, which generally applies to farmers' purchasing power and expenditure, our analytical framework is built on the idea of economy-wide spillovers and our data capture the economy-wide effects.

general interdependency of rural and urban areas. The first order effects, similarly to Pillar 1, are due to the fact that there is a flow of funds into some rural households which increases their purchasing power. Additionally, e.g. RD measures for investments in physical assets - farm modernisation, infrastructure, energy-saving technologies - may influence employment in research and development, construction, technical services, etc. Business start-up aid for young farmers and for non-farm enterprises, as well as village renewal support, can have a direct effect on employment in rural and surrounding urban areas. Support to enhance biodiversity and the provision of higher-value ecosystem services may help to create non-farm jobs in rural tourism and associated services. Policy developments within the food system, e.g. short food chains, organic box trade, and traceability, can produce employment growth along the entire agri-food supply chain.

However, the form and the level of CAP payments vary across the UK. Table 1 presents some indicators that exemplify the striking differences in agricultural sectors across its four constituent countries.

- Table 1 here –

Less Favoured Areas (LFA) payments in England are less important than in the other three countries where 70 per cent and more of the agricultural area is designated as LFA. Around half of the land area in England is under crops, whilst in the other countries it is either predominantly grass land (Northern Ireland and Wales) or rough grazing (Scotland). These production patterns, together with farm size and productivity effects, has led to a different reliance on subsidies: the lowest in England at 52 per cent of the total income from farming, and highest in Wales at 142 per cent (Allen *et al*., 2014).[2]

Table 2 presents in more detail the CAP payments by Pillar in the UK and the constituent countries since 2010 – the first year available which falls within the period of analysis in this paper. The UK constituent countries took different implementation decisions on the decoupled direct payment (SFP) - Scotland and Wales introduced the SFP on a historical basis, England opted for a dynamic hybrid version, and Northern Ireland for a static hybrid one.

- Table 2 here –

3 Theoretical framework: firm employment function

[2] Total income from farming is the return on own labour, capital and management input of all those with an entrepreneurial involvement in farming, generally farmers and partners. It is measured at sectoral level and represents the net value added at factor cost minus the compensation of employees, rent and interest.

The aim of this paper is to empirically evaluate the CAP payment impact on employment in the non-farm economy. Therefore, the focus here is not on developing a fully-fledged theoretical model of all possible channels of impact but rather it is on outlining a theoretical framework to motivate an appropriate estimating specification and the interpretation of results. The theoretical framework employed is based on Smolny's (1998) monopolistic competition model with delays in adjustment in price, employment, and capacity.[3] The framework leads to a theoretically motivated firm employment (demand) function. Furthermore, the framework is suitable for analysing spillover effects because it is based on realistic assumptions for the timing of decisions, clearly distinguishing between short-, medium-, and long-run. The timing assumptions are as follows. In the short run, only output is endogenous. Employment and prices adjust in the medium run, with a delay with respect to demand and cost changes, thus under uncertainty about demand. Capacities and the production technology are predetermined for the price and employment adjustment process, and react only in the long run.

The assumption about delays in the reduction of employment can be justified by legal and contractual periods of notice; there often are also substantial severance costs. In addition, reputational losses for firms in the case of frequent dismissals tend to restrict the downward adjustment of the labour force to normal separations, i.e. resignations and retirements. Delays in the upward adjustment of the labour force involve search, screening and training time. A delayed adjustment of prices corresponds to the assumption of price tags and menu cost. Importantly, even a short delay between the decision to change employment and/or the price and the realisation of a demand shock can introduce considerable uncertainty in adjustment for the firm. The dynamic decision problem of the firm can be reduced to a sequence of static decision models which are solved stepwise.

We start by specifying a log-linear demand function for the firm's product (ln*D*) that allows us to distinguish between the effects of price elasticity of demand, demand shifts, and demand uncertainty:

$$lnD = \eta . lnp + lnZ + \varepsilon, \quad E(\varepsilon) = 0, \quad Var(\varepsilon) = \sigma^2. \qquad (1)$$

[3] Smolny's (1998) model is related to the family of so called putty-clay models which have a long history in the growth and business cycle literature with micro foundations (Johansen 1959; Solow 1962; Phelps 1963; Sheshinski 1967; Cass and Stiglitz 1969; Bresnahan and Ramey 1994; Cooper, Haltiwanger, and Power 1999; Gilchrist and Williams, 2000).

In equation (1), D is negatively associated with price, p, with constant elasticity η, Z is a vector of exogenous or predetermined demand measures, such as aggregate industry demand $\overline{D}$ and demand shifters induced by market factors or policy, and the error term ε (with zero expected mean) captures the realised value of the demand shock which is not known at the time of the price and employment decision. The time and firm indexes are omitted for notational convenience.

In this paper the information content of the Z-vector in the demand function is extended with the CAP expenditure indicators.[4] Following the discussion in the previous section and findings in the limited literature on the impact of CAP subsidies on regional development (Vatn, 2002; Peterson *et al*., 2002; Rizov, 2004; 2005), we argue that the inter-sectoral spillovers and the local economy diversification effects of subsidies are associated with the expansion of aggregate demand that non-farm sector firms face.[5] This first-order, demand effect is likely to impact significantly on non-farm sector firm employment.[6]

According to equation (1), another effect of CAP subsidies on non-farm firm demand and employment could occur through the volatility of demand captured by the variance of demand σ^2; such subsidies would generally reduce volatility of demand, and thus smooth employment adjustments. Following this argument, while subsidies would not affect the mean of ε they may affect σ.

To complete the model, we specify firm supply (S) function determined by a short-run production function with capital K and labour L as inputs:

$$S = \min(Y_K, Y_L) = \min(\pi_K . K, \pi_L . L), \qquad (2)$$

where Y_K is capacity, Y_L is the employment constraint, and π_K, π_L are the productivities of capital and labour respectively. In the short run, output Y is determined as the minimum of supply and demand:

[4] The extension of the demand equation (1) with CAP expenditure information partially addresses omitted variables concerns when specifying an estimating equation. To further deal with omitted variable concerns at the estimation stage we also use sets of location, industry, and time dummies.

[5] The diversification of the local economy driven by CAP payments can be seen as a sustainable development effect, considering that a diversified local economy would be more resilient to economic shocks (Barkley, 1995; Stavins *et al*., 2003).

[6] There could also be a second-order, supply effect derived through different channels such as changes in competition and agglomeration in the upstream and/or downstream industries, but our focus here is on the first-order (dominant) demand effect. The second-order supply effect is controlled for in the estimation stage by firm characteristics such as size, age, and cost-per-employee, which is also a measure of productivity.

$$Y = \min(S, D). \tag{3}$$

The medium-run optimisation problem is

$$\max_{p,L} \quad p.E(Y) - w.L - c.K, \tag{4}$$

subject to equations (1) and (2), where *E* is the expectation operator. Wage costs *w* and user costs of capital *c* are treated as exogenous at the firm level. There are two relevant optimization scenarios where capacity is, or is not, binding on decisions.[7] In the case of capacity constraint, employment is determined from the capacity. No more workers will be hired than can be employed with the predetermined capital stock. Supply and employment result from:

$$S = Y_L = Y_K, \qquad L(Y_K) = \frac{Y_K}{\pi_L}. \tag{5}$$

The optimal price depends on capacities, expected demand shifts, demand uncertainty and competition. In the capacity-constrained scenario, the adjustment of employment is inhibited, and the whole adjustment with respect to expected demand shifts falls on the price. The implication is that level of employment will remain unchanged.

In the case of unconstrained capacity, which is the most likely case in the UK market economy, optimal employment and price are jointly determined by setting marginal costs of employment, i.e. the wage rate *w*, equal to the marginal revenue. The latter is determined as the price, multiplied by the productivity of labour, and multiplied by the probability that the additional output can be sold, i.e. that demand exceeds supply:

$$p(w).prob(Y_L < D).\pi_L - w = 0. \tag{6}$$

[7] For completeness, we point out a third scenario in which labour supply is constrained, i.e., the firm does not have sufficient number of applicants. In this case, optimal employment is determined by the (exogenous) labour supply which in turn may depend on local market conditions, and regional and national policies including the CAP and movement of labour laws. Given the setup of our framework, the labour supply constraint is predetermined in short and medium runs. Nevertheless, in our empirical analysis we use locational controls such as the rural-urban dummy and clustering at constituent country level, as well as sets of time and industry dummies which proxy for possible exogenous labour supply constraints.

The optimal price is determined by unit labour costs w/π_L, and the mark-up is equal to the probability of a supply constraint on the goods market. This probability is determined by the price elasticity of demand and demand uncertainty, i.e. the optimal price is independent of expected demand shifts as set out in equation (1).

Optimal supply and employment are derived from

$$S = Y_L(w) = \eta . lnp(w) + lnZ + \bar{\varepsilon}(\eta, \sigma), \tag{7a}$$

$$L(w) = \frac{Y_L(w)}{\pi_L}, \tag{7b}$$

where $\bar{\varepsilon}(\eta, \sigma)$ is the value of the demand shock which distinguishes the supply-constrained regime from the demand-constrained regime.[8] Demand shifts induced by the expansion of demand due to the spillovers and diversification effect of CAP payments lead to growth in employment. An immediate adjustment of employment is contained as the limiting case with σ→0. Introducing uncertainty reduces the expected utilisation of employment, and has the same effect on prices and employment as higher variable costs. Thus, uncertainty reduces optimal employment and increases the price through the costs of underutilisation of employment. However, as argued earlier, if CAP payments reduce uncertainty, then there will be less underutilisation of labour and employment would relatively rise.

Assuming log-normal distribution of ε which follows from equation (1), equation (7b) can be written in a log-linear form which is the basis of the estimating specifications in this study:

$$lnL = -ln\pi_L + \eta . lnp(w) + lnZ + \bar{\varepsilon}(\eta, \sigma). \tag{8}$$

Thus, employment is a function of CAP payments as well as labour productivity, aggregate market demand, firm demand variance, firm-specific characteristics such as size, measured by total assets, and age. In the estimating specifications, we include industry, location (rural-urban) and time dummy controls capturing the effects of price elasticity of demand and market structure.

[8] Note that $\bar{\varepsilon} = lnS - LnD$ and its optimal value depends only on η and on the parameters of the probability density function (pdf) of $\bar{\varepsilon}$. A pdf of $\bar{\varepsilon}$ which is completely characterised by its expected value and variance can be written as $\bar{\varepsilon}(\eta, \sigma)$.

The framework outlined above is useful for the analysis of employment adjustment and price rigidities during the business cycle in general, and of the implications of the CAP payments in particular. Suppose that the stochastic process generating demand shocks is auto-correlated, i.e. firms expect that demand shocks are persistent. Then, unexpected demand shocks affect the utilisation of labour and capital contemporaneously. If the actual utilisation differs from the optimum, employment and/or prices adjust as the adjustment depends on the availability of capacity. In the case of a capacity constraint (in boom periods), employment would remain unchanged, and the firm would adjust the price. With a sufficient capacity (in recession periods), the firm would adjust employment, and the price would remain unchanged. CAP payments resulting in sustained higher demand and smoothing the demand fluctuations thus lead to larger firm capacities and more employment; in the long run they would also lower the probability of demand shocks hitting the capacity (supply constraint).

The framework yields a further hypothesis about the effects of the price elasticity of demand on employment and price adjustment. In the case of demand shocks, a low price elasticity of demand $|\eta|$ should favour employment adjustments against price adjustments.[9] Finally, another set of potential hypotheses is on the relationship between employment adjustment and firm size. First, scale economies in larger firms should reduce production costs which permit them to set lower prices, and increase output and employment. Second, adjustment costs for prices and employment might differ according to firm size due to technology specificity. Third, larger firms have larger market shares, which should be associated with less competition and less uncertainty about demand. Considering all these potential effects makes it theoretically ambiguous whether large firms relatively increase employment, and therefore this is a question for the empirical analysis.

4 Data and estimation strategy

The firm employment function formulated in equation (8) was estimated using the FAME data set of Bureau van Dijk combined with detailed subsidies data extracted from the DEFRA CAP Payments database. FAME covers all firms filed at Companies House in the UK, and includes information on detailed unconsolidated financial statements, employment, location by post code, and activity description. The data used in the analysis contains annual records

[9] Hypotheses for the analysis of effects of competition on employment and price adjustments could also be formulated but they are beyond the purposes of the analysis here.

on over 2 million firms over the period 2008–2014. The geographic distribution of the firms in the dataset which are available for analysis is presented in Figure 1. The coverage of the data compared with the aggregate statistics reported by the UK Office for National Statistics (ONS) is very good as regards sales (89 per cent) and employment (90 per cent).

- Figure 1 –

While partially available for all years from 2006 to 2014, the CAP subsidy data is not complete for some years. This is to a great extent a result of amendments to Commission Regulation (EC259/2008). Following a decision of the European Court of Justice, for some years after 2008 the Commission removed the requirement to publish subsidy payment data on farming individuals and partnerships, though MSs were still obliged to publish data on legal entities. In 2013, the Commission introduced new rules for transparency, including both individuals and all legal entities. The only exception was for very small beneficiaries who receive less than €1,250 in total subsidy (equivalent to £1,045 in 2014 and £972 in 2015); their names were withheld and replaced by a code number. Therefore, the workable dataset available for this study covers four years: 2008, 2010, 2012, and 2014. The CAP payment information comprises the amount of total subsidy and its three components: common market organisation (CMO) and direct payments (DP) or aka single farm payment (SFP) made under CAP's Pillar 1, and rural development (RD) payments made under Pillar 2. The geographic distribution of the annual CAP payments in the dataset is presented in Figure 2

- Figure 2 –

The industry sectors are identified on the basis of the 2007 UK Standard Industrial Classification (SIC) at the 4-digit level. Given the large number of 4-digit industries, on several occasions, for definition of specific variables the more aggregated 2-digit codes were used. All nominal monetary variables were converted into real values by deflating with the appropriate ONS industry deflators at 4-digit UK SIC level, when available, and at 2-digit level otherwise. The producer price index (PPI) was used to deflate sales, wages and CAP payments, and asset price deflators were used for deflating firm capital.

To account for inter-industry linkages, which are important for the transmission of the CAP expenditure effects from agriculture to non-agricultural sectors, the input-output (I-O) shares of the agriculture, forestry and fishing sector in all other sectors were used averaged over the 2005-2010 period. Data was obtained from OECD symmetric I-O tables which represent a complete picture of the sectoral interdependencies in the UK economy. The shares (aka technical coefficients) were used as regression weights to account for the sectoral interdependence affecting the transmission of the CAP expenditure effects to the non-farm

sector firms. It is reasonable to assume that CAP expenditure will have stronger effect on firms from sectors closely linked to the farm sector. This is captured by the I-O shares - firms from sectors with higher I-O shares are treated as more important.

The empirical analysis is based only on data for SMEs, i.e. enterprises with less than 250 employees, in FAME. Definition of variables and descriptive statistics calculated from the estimated sample of SMEs are reported in Table 3. Average SME characteristics are presented by rural and urban locations in Table 4. Generally, there are no important differences in summary statistics between rural and urban firms, but rural SMEs are slightly larger as measured by employment and smaller in assets, and they face smaller local market demand. The cost of employees (and wages) also is lower in rural SMEs. In rural areas, more CAP payments are received than in the urban areas as exemplified by the total subsidy and the higher share of direct payments. It is noteworthy that our location-based CAP payments measure confounds the amount of payments received by individual farms with the size of the farm sector at the location considered; nevertheless, such measure suffice our analytical purpose.

- Tables 3 and 4 here –

To estimate the impact of CAP payments on the level and growth of employment, capturing long- and short-run effects respectively over the period 2008-2014 in 2-year intervals, a panel generalised method of moments (GMM) estimator, based on Arellano and Bond (1991), and specifically its extension to system GMM by Blundell and Bond (1998), was used. The GMM estimator controls for unobserved firm heterogeneity and for potential endogeneity of the firm-level explanatory variables. In the estimation, given the firm-level dependent variables, the sector-level, regional-level, and the time dummy explanatory variables are treated as exogenous.

5 Results

The estimation results from the SME sample, for two specifications with dependent variables log of employment and growth rate of employment respectively capturing long- and short-run effects are presented in Table 5.[10] As previously mentioned, in the estimations, the I-O shares were used to weight each firm-level observation, while the observations are also clustered at constituent-country level to account for the policy environment and structural factors in each

[10] We have run the same set of estimations on the full sample of firms (large and SMEs), and the results obtained are qualitatively similar to the ones reported.

country.[11] The estimated coefficients of all theoretically motivated control variables as per equation (8) are significant and have the expected signs. There is no evidence of second-order autocorrelation or weak instruments considering the AR(2) and Hansen-J tests respectively.

- Table 5 here –

The variable in the focus of the analysis – the CAP payments – has a statistically significant effect on both employment levels and growth rates. While the magnitudes of the coefficients, representing elasticity appear small, they are of economic significance. The impact of CAP payments on employment levels is 0.016 (Table 5), which means that completely removing the CAP payments in the UK would result in 1.6 per cent drop in employment in non-farm SMEs from the current level, c*eteris paribus* (no alternative money spent in the UK by new national agricultural policy). Given our framework and considering that according to ONS (2015) SMEs employed 15.6 million people in 2015, a drop of 1.6 per cent is equivalent to about 250,000 jobs. In terms of employment growth, the estimated coefficient of 0.004 implies a drop in annual employment growth of about 0.2 percentage points if CAP payments were completely removed. This represents a 20 per cent drop in the current annual employment growth rate in non-farm SMEs which was on average just under 1 per cent in our estimated sample of SMEs. These estimated (direct) effects are likely to be the lower bound of the total effects, considering that the aggregate market demand variable may be capturing some of the CAP spillovers as well, i.e., some of the employment increase due to higher demand is in fact and indirectly driven by the (past) CAP expenditure contribution to the shift in demand.

Besides the effect of total CAP payments on employment levels and growth rates, the composition of these payments also has a statistically significant impact. Relative to Pillar 2, Pillar 1 payments (CMO and SFP) have a stronger positive statistically significant l effect of about 5 per cent on employment level. There are no statistically significant differences in payment composition effects on employment growth. The finding that Pilar 1 has a stronger impact on employment level than Pillar 2 is interesting and suggests that, although in theory decoupled from farm output levels, Pillar 1 payments do in fact affect the supply and demand (up- and down-stream) linkages between firms (and industries) which are associated with

[11] Clustering of observations allows for correlation of observations within each constituent country which in turn results in robust standard errors estimated. The four constituent countries differ in their implementation and administration of the CAP payments as well as there are structural differences in terms of agricultural land rental arrangements and proportions. It is noteworthy that the rental patterns are quite homogeneous within a constituent country and stable over time; this the country controls do capture important information on the CAP payments utilisation.

agriculture. Thus, the SFPs appear to be an important factor driving the CAP payment spillover effects on non-farm employment.

- Table 6 here –

In Table 6, the same two specifications as in Table 5 are estimated but augmented with an interaction term between the CAP payments and the rural area indicator to identify rural-area specific impact on employment. The estimated coefficient of the interaction term in the equation for employment level is statistically significant, and its magnitude suggests that the long-run impact of CAP payments on employment is in fact concentrated in the rural SME sample, considering that the main CAP payment effect loses statistical significance. Furthermore, the rural dummy coefficient turns negative and remains significant, suggesting that without the CAP payments employment in rural areas would be lower compared to urban areas. Again, given our estimation framework and considering that rural SMEs employed over 2 million people in 2015 (ONS, 2015) completely removing the CAP payments would lead to losing more than 200,000 rural jobs. If indeed these lost jobs are mostly concentrated in the rural areas, the negative impact on the rural job market would be significant. In terms of employment growth, there is no statistically significant difference in effects between rural and urban SMEs.

Conclusions

This paper aims at filling the gap in the literature concerned with the effects of CAP payments to farms on employment in local and general bon-farm economies. Whilst most previous studies have focused only on the effect of the CAP on employment in agriculture and/or in rural areas, this paper investigates explicitly the inter-sectoral spillovers without limiting itself to the boundaries of ‘rural’. The theoretically founded estimation framework developed in this study leads to a firm employment function which is estimated with the FAME dataset containing rich firm level information. The estimated sample comprises about 200,000 firm-year observations and covers all industries in the UK economy. Two specifications of the employment function were estimated, with employment level and growth rate respectively as dependent variables. The estimated sample consisted of SMEs only as these represent the majority of employing private businesses in the UK, particularly in rural areas. A distinctive feature of the study is the micro-data approach and the wide coverage of all sectors in the economy.

The CAP has been subject to many criticisms by economists due to its market-distorting effects, even after the “decoupling” of direct payments from farm production

levels, and due to the blanket income support to farmers, which attenuates their incentives to stay competitive and profitable without substantial public transfers. However, this study has found a net positive effect of the CAP payments on non-farm employment, and in particular a strong positive effect of the SFPs compared with the RD payments. The interaction between CAP and rural areas also exerts a strong positive effect on the level of employment.

Under an extreme policy scenario in which the CAP payments are completely removed without compensating/countervailing measures, the impact on UK employment would amount to about 250,000 jobs lost. The statistical significance of an interaction term between CAP payments and rural areas suggests that the removal of CAP payments would be likely to have rural development implications beyond employment lost, e. g. a further outflow of population from rural areas, and in particular of young people wanting jobs outside farming. Furthermore, if the extra jobs at firm level supported by the CAP were removed, there could also be a negative efficiency effect, due to reduction of the scale of operation below the minimum efficient scale for some SMEs; such firms may become unviable in the long run.

A caveat to these results and discussion is that they are based on a partial equilibrium *ceteris par*ibus analysis. This suggests that the findings should be interpreted as relevant to the question on the impact of CAP subsidy on jobs in the UK within the EU membership context rather than Brexit, which would clearly be associated, besides withdrawal from CAP, with important changes in the UK's trade regime and the overall functioning of the economy.

Furthermore, the results should not be interpreted as an attempt to justify the role of SFP type of subsidies as a job creation policy across the EU because there might be other non-agricultural labour market policies which could be more efficient in increasing or sustaining employment opportunities in non-farm enterprises. Nevertheless, this study sends the message that a broader approach is necessary in analysing the implications of the CAP, as its impact is felt well beyond agriculture.

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Table 1: Indicators of UK farming by constituent country, 2013

Indicators	England	Northern Ireland	Scotland	Wales
Total agricultural area (million ha)	9.5	1.0	6.2	1.7
Number of farms (‘000)	101	24.5	52.7	42.3
Average farm size (ha)	90	41	106	37
Crops/grass/ rough grazing (% of total agric. area)	40/44/10	5/78/17	10/24/66	5/68/27
Less favoured area (%)	17	70	85	81
Gross output per farm (£’000)	189.3	78.4	59.6	26.1
Gross output per ha (£)	2016	1925	507	879
Net Farm Income (average all farm types, £’000)	34	13	21	17

Source: Allen *et al.* (2014).

Table 2: CAP payments by funding stream and constituent country, € million *

	2010	2011	2012	2013	2014
UK Total	*4337*	*4327*	*4433*	*4417*	*4299*
Pillar 1	3424	3309	3348	3326	3234
of which DP	3325	3304	3290	3285	3195
CMO	99	5	58	41	39
Pillar 2 **	913	1018	1085	1091	1065
of which EAFRD	512	653	742	752	798
England Total	*2761*	*2696*	*2777*	*2792*	*2714*
Pillar 1	2199	2099	2146	2126	2048
of which DP	2100	2094	2088	2085	2009
CMO	99	5	58	41	39
Pillar 2 **	562	597	631	666	666
of which EAFRD	348	448	470	532	563
Wales Total	*413*	*417*	*426*	*406*	*413*
Pillar 1 DP	316	312	309	309	301
Pillar 2 **	97	105	117	97	112
of which EAFRD	38	45	54	48	54
Scotland Total	*779*	*826*	*840*	*819*	*757*
Pillar 1 DP	589	583	584	583	566
Pillar 2 **	190	243	256	236	191
of which EAFRD	92	123	167	113	119
Northern Ireland Total	*384*	*388*	*390*	*400*	*415*
Pillar 1 DP	320	315	309	308	319
Pillar 2 **	64	73	81	92	96
of which EAFRD	34	37	51	59	62

Source: Agriculture in the United Kingdom (2014).

Notes: DP – Direct Payments; CMO – Common Market Organisation; EAFRD – European Agricultural Fund for Rural Development. * Annual data is for the EU financial year 16th October – 15th October. ** The difference between the total Pillar 2 and the amount received from EAFRD indicates the national co-financing.

Table 3 Definition of variables and summary statistics

Variable	Definition	Mean (S.D.)
Employment	Number of full-time equivalent firm workers, log	3.07 (1.50)
Employment growth	Growth rate of firm employment	0.01 (0.23)
Market demand	Annual 2-digit SIC by TTWA aggregated demand in thousands GBP, log	13.83 (3.41)
Demand variance	Firm revenue deviation from 2-digit SIC geometric mean	0.99 (2.11)
Cost per employee	Annual firm wage bill per FTE worker in thousands GBP, log	2.99 (1.24)
Firm size	Value of firm total assets in thousands GBP, log	7.18 (2.60)
Firm age	Firm age in years	17.98 (17.93)
Total subsidy	Value of total CAP subsidies (Pillars 1 and 2) at 4-digit postcode district in thousands GBP, log	8.78 (1.79)
CMO share	Share of common market organisation (CMO) subsidy, Pillar 1	0.04 (0.11)
DP share	Share of direct payments (DP) aka SFP, Pillar 1	0.67 (0.41)
Pillar 1 share	Share of Pillar 1 (CMO+DP)	0.71 (0.39)
RD share	Share of rural development payments (RD), Pillar 2	0.29 (0.39)
Manufacturing	Dummy for manufacturing industries	0.12 (0.33)
Construction	Dummy for construction and utilities industries	0.09 (0.28)
Services	Dummy for service industries	0.79 (0.41)
Rural area	Dummy for rural areas according to the DEFRA (wider) definition of rurality	0.17 (0.38)

Notes: Total number of observations: 190,348 for 2008, 2010, 2012 and 2014.

Table 4 Summary statistics for rural and urban samples of SME firms

Variable	Rural mean (S.D.)	Urban mean (S.D.)
Employment	3.09 (1.55)	3.06 (1.49)
Employment growth	0.01 (0.20)	0.01 (0.23)
Market demand	11.84 (3.40)	14.24 (3.26)
Demand variance	0.81 (2.06)	1.03 (2.12)
Cost per employee	2.82 (1.21)	3.03 (1.24)
Firm size	7.12 (2.61)	7.19 (2.59)
Firm age	18.65 (17.97)	17.85 (17.92)
Total subsidy	9.08 (1.79)	8.71 (1.78)
CMO share	0.02 (0.09)	0.04 (0.12)
DP share	0.76 (0.34)	0.66 (0.42)
Pillar 1 share	0.78 (0.33)	0.70 (0.40)
RD share	0.22 (0.33)	0.30 (0.40)
Manufacturing	0.16 (0.36)	0.12 (0.32)
Construction	0.10 (0.30)	0.08 (0.28)
Services	0.74 (0.44)	0.80 (0.40)
Number of observations	32,788	157,560

Table 5 Regression results for the full SMEs sample

Dependent variable	ln(empl)	Δ(empl)
Explanatory variables	(1)	(2)
Market demand	0.114 (0.015)**	0.096 (0.006)**
Demand variance	-0.215 (0.074)**	-0.303 (0.023)**
Cost per employee	-0.222 (0.087)**	-0.749 (0.154)**
Firm size	0.093 (0.018)**	-0.024 (0.010)**
Firm age	0.022 (0.004)**	0.010 (0.002)**
Total subsidy	**0.016 (0.005)****	**0.004 (0.001)****
Pillar 1 share	**0.048 (0.010)****	**0.007 (0.010)**
Rural area	0.105 (0.023)**	-0.006 (0.018)
2010	-0.108 (0.006)**	-0.025 (0.004)**
2012	-0.168 (0.008)**	-0.013 (0.010)
2014	-0.185 (0.008)**	-0.006 (0.008)
Number of observations	190,348	190,348
AR(2), p-value	0.16	0.06
Hansen J, p-value	0.99	0.99

Notes: Robust standard errors are reported in parentheses; level of significance ** 1%, * 5%. A set of 2-digit SIC industry dummies with reference category food processing is included in all regressions.

Table 6 Regression results for the full SMEs sample with rural-subsidy interaction

Dependent variable	ln(empl)	Δ(empl)
Explanatory variables	(1)	(2)
Market demand	0.111 (0.013)**	0.097 (0.006)**
Demand variance	-0.215 (0.074)**	-0.305 (0.024)**
Cost per employee	-0.198 (0.097)*	-0.752 (0.150)**
Firm size	0.096 (0.020)**	-0.023 (0.011)*
Firm age	0.021 (0.005)**	0.010 (0.002)**
Total subsidy	**0.011 (0.018)**	**0.002 (0.001)***
Pillar 1 share	**0.044 (0.008)****	**0.009 (0.010)**
Total subsidy*Rural area	**0.120 (0.060)***	**0.037 (0.037)**
Rural area dummy	-0.386 (0.163)*	-0.032 (0.033)
2010 dummy	-0.111 (0.009)**	-0.024 (0.004)**
2012 dummy	-0.170 (0.010)**	-0.012 (0.010)
2014 dummy	-0.183 (0.008)**	-0.007 (0.008)
Number of observations	190,348	190,348
AR(2), p-value	0.05	0.06
Hansen J, p-value	0.99	0.99

Notes: Robust standard errors are reported in parentheses; level of significance ** 1%, * 5%. A set of 2-digit SIC industry dummies with reference category food processing is included in all regressions.

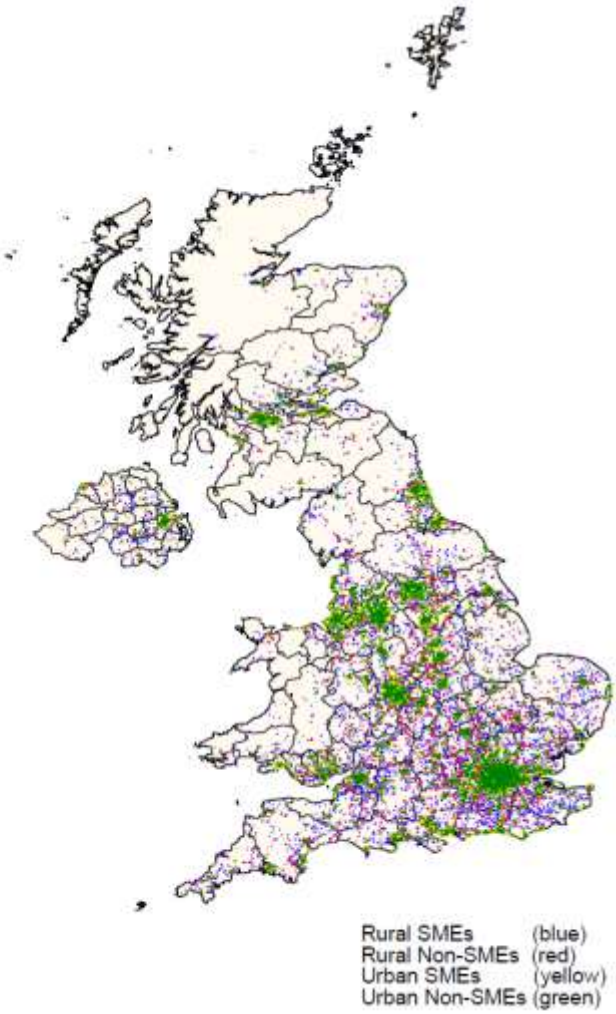

Figure 1 Geographic distribution of firms in the UK

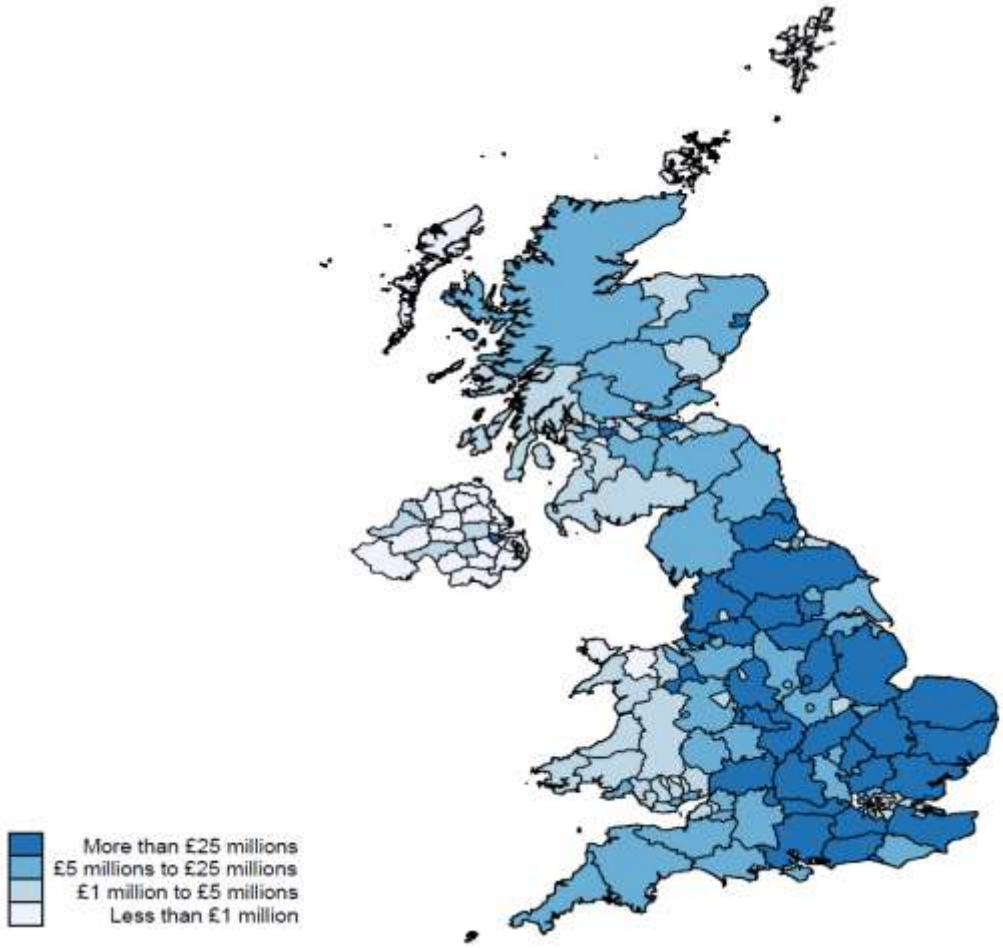

Figure 2 Geographic distribution of annual CAP payments