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

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Abstract

This study is concerned with assessing the contribution of the EU's Common Agricultural Policy (CAP) to non-farm employment in the UK, through its direct and indirect effects on agriculture, up- and downstream industries, and the diversification of rural areas. We employ a micro approach, based on company data from FAME dataset combined with detailed subsidies data from DEFRA. We focus on employment in small and medium enterprises (SMEs) which are central for job creation. As a theoretical framework for our empirical firm employment function we employ a monopolistic competition model with delays in adjustment in prices, employment, and capacity. The generalised method of moments (GMM) is used to estimate the effect of CAP payments on both the level and growth of employment. Our estimation results suggest positive spillovers of CAP payments to non-farm employment. Although the magnitude of the effects is small, it is economically significant especially for the rural labour market.

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

Introduction

This study is concerned with the issues arising from the need to assess the contribution, if any, of the EU's Common Agricultural Policy (CAP) to non-farm sector employment in the UK, through its direct and indirect effects on agriculture, up- and downstream industries, and the diversification of rural areas. In recent years, given the difficult recovery from the economic and financial crisis, the provision of employment is of primary interest to policy makers and millions of UK citizens. Additionally, whatever the UK package for Brexit will be, it is almost certain the UK will leave the CAP. It is useful to have some indications about the possible benefits or losses beyond agriculture and the food (fibre and biofuel) chain by investigating the inter-industry spillovers of CAP 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 this respect, CAP could hardly have further impact in the direction of job creation or job maintenance in primary agriculture. However, the inter-industry spillovers of the CAP payments on non-farm employment could more than compensate for any loss of on-farm employment.

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 measures have different employment effects, i.e. Pillar 1 decoupled direct payments and Pillar 2 rural development payments.

Most of the previous research has focused on the CAP impact on agriculture and rural jobs, often in a regionalised framework (for example see Petrick and Zier, 2011; 2012; Olper et al., 2014). Others address 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 on creation of rural jobs has reviewed 53 studies. All 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 from this bulk of literature is the paper by Blomquist and Nordin (2013) estimating an open economy relative multiplier for the Swedish case using an

exogenous change in the CAP. The present paper tries to fill the gap in the literature and engage in a broader debate about the wider, inter-industry employment effects of the CAP.

The study employs a micro approach – it is based on company data extracted from FAME dataset of Bureau van Dijk combined with detailed subsidies data extracted from DEFRA CAP Payments. Only the effects on employment in small and medium sized enterprises (SMEs) is analysed. SMEs are defined following the definition used 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, accounting for 59.3 per cent of private sector employment and 48.1 per cent of private sector turnover in the UK (Department for Business Innovation and Skills, 2013). They are also central to job creation. 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 to large companies (national and international) located in metropolitan areas may mean to compare apples and oranges. As an illustration, if on average the SMEs account for 99 per cent of private businesses in the UK, in the London area between 2001 and 2012 their share fluctuated from 39 to 42 per cent (ONS, 2013).

The theoretical underpinning of the analysis is based on Smolny's (1998) monopolistic competition model with delays in adjustment in 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 spillovers of CAP payments, although the magnitude of coefficients is rather small. Looking at different CAP measures, relative to other CAP expenses, Pillar 1 direct payments have a strong statistically significant effect on the level of employment but not on employment growth. As expected, the CAP long-term effect 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 a constituent country. Section three details the theoretical framework and section four presents the data and the estimation strategy. Section five discusses the results while section six concludes.

The CAP subsidies evolution and implications for employment

The period covered in the empirical analysis ranges from the CAP Health Check in 2008 to 2014 - the first transitional year of the 'new' CAP for 2014-2020. The presentation of the implementation of different CAP measures in the UK is only limited to the period analysed,

since a wider discussion of the CAP evolution, reforms and impact are beyond the scope of the present paper.

The Health Check of 2008 introduced the most recent policy changes before the implementation of the last CAP reform designing the EU policy for the period 2014-2020 (Allen et al., 2014). It has not changed the fundamental decisions taken in the 2003 CAP reform, i.e. the introduction of a decoupled Single Farm Payment (SFP) conditional on cross-compliance and keeping the land in Good Agricultural and Environmental Conditions (GAEC). To some extent, the Health Check has moved the policy slightly further into the direction of the 2003 CAP reform, i.e. it has decreased the coupled payments, increased the modulation and removed set-aside. It has also provided the EU Member States (MSs) with a flexible possibility to assist sectors with special problems, the so-called Article 68 measures.

In the Council Regulations of 2003, establishing the rules for direct support schemes, the single payment scheme is treated as income support (OJ, 21/10/2003). The SFP is paid to farmers with a broad definition that the farmer could be a natural or legal person, or a group of natural or legal persons. This is important for defining some of the channels through which we may expect CAP expenditure to affect non-farm employment. The increase in the incomes of farmers due to SFP can 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. This growth in terms of farmers' household income/expenditure generated mainly in rural areas may or may not correlate with increased employment in those areas, taking into account purchases at a distance and services provided from urban areas.

Although the consumption effect has not been widely discussed in studies on decoupling, it was documented that the introduction of the Production Flexibility Contracts (PFCs) in the US by the 1996 Federal Agriculture and Reform Act (FAIR) brought about a difference in consumption expenditure between households included in the programme and similar income households who were non-beneficiaries of PFCs (Burfisher and Hopkins, 2003). Additionally, although in theory decoupled, the SFP may be invested in farm production and thus increase or maintain the employment in up- and downstream industries. Bhaskar and Beghin (2007) reviewed a bulk of studies on the coupling mechanisms of decoupled payments. Some of these mechanisms include wealth and insurance effect that might increase the use of inputs and affect the increase in output; effect on investment decisions as farmers might be able to save more and invest more; increased liquidity of credit-constrained households and appreciation of land values which facilitate the access to

credit. In summary, 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 via its coupled effect on farm investments and output level. Both these channels would lead to expansion in the demand that non-farm sector firms face.

Concerning Rural Development (RD) measures, there are a wide range of channels through which payments can affect non-farm employment. Rizov (2004) studies the effect of CAP on rural communities since the introduction of Pillar 2. He develops 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 growth both within the local rural community and beyond, in the urban areas which underlines the general interdependency of rural and urban areas. For example, RD measures for investments in physical assets - farm modernisation, infrastructure, energy saving technologies - may influence employment in research and development, construction, technical services, etc. The business start-up aid for young farmers and for non-farm activities, 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 help the creation of non-farm jobs in rural tourism and associated services. Policy developments within the food system, e.g. short food chains, organic box trade, 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 territory. Since this study covers the whole of the UK, it is important to take into account the heterogeneity of the CAP implementation and the different level of the CAP expenditure as a result of political decisions, as well as in response to the variety of agricultural practices, technology, and land use in different regions and constituent countries. Table 1 presents some indicators that exemplify the differences in agricultural sectors across constituent countries.

- Table 1 here –

Table 1 indicates some striking differences which, beyond doubt, may lead to different level of CAP payments. Obviously, in England Less Favoured Areas (LFA) payments are of less importance that 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 other countries it is either predominantly grass land (Northern Ireland and Wales) or rough

grazing (Scotland). The latter, together with farm size and productivity effects, has led to a different reliance on subsidies – the lowest in England – 52 per cent of the total income from farming and the highest in Wales - 142 per cent (Allen et al., 2014).[1]

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

- Table 2 here –

The table shows the differences in the CAP support distribution by UK constituent country as well as the almost negligible role of market price support (MPS). Having in mind the substantial differences in CAP payments in different countries, the empirical strategy controls for these by clustering firm-level observations at the constituent country level.

Theoretical framework: Firm employment function

As previously mentioned, the aim of this study is to empirically evaluate the CAP 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 for the analysis at firm level is based on Smolny's (1998) monopolistic competition model with delays in adjustment in price, employment, and capacity.[2] The framework leads to a firm employment (demand) function that is theoretically well motivated. 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 and long run effects. The timing assumptions are as follows. In short run only output is endogenous. Employment and prices adjust in medium run, with a delay with respect to demand and cost changes, thus under uncertainty

[1] 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.
[2] 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).

about demand. Capacities and the production technology are predetermined for the price and employment adjustment process and react only in long run.

Delays in the reduction of employment can be justified with legal and contractual periods of notice; there often are also substantial severance costs. In addition, reputation losses for firms in the case of frequent dismissals tend to restrict the downward adjustment of the labour force to normal separations, i.e. quits and retirement. Delays for an 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 for the firm. The analysis of the dynamic adjustment in terms of adjustment delays and uncertainty, which is a relevant context for modelling the CAP impact on employment, reduces the dynamic decision problem of the firm to a sequence of static decision models which can be 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:

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

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 captures the realised value of the demand shock which is not known in the time of the price and employment decision. The time and firm indexes are omitted for notational convenience.

In this study the information content of the *Z*-vector in the demand function is extended with the CAP expenditure effects. Following the discussion in 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) we argue that the inter-sectoral spillovers and diversification and sustainability effects of subsidies on the local economy are associated with the expansion of aggregate demand that non-farm sector firms face.[3] This is the first

[3] 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).

order effect that is likely to significantly impact on non-farm sector firm employment.[4] Thus, the main impact of the CAP payments on the non-farm firms operating in the local economy is through the inter-sectoral spillover and local economy diversification channels leading to the generation and expansion of alternative non-farm businesses at local economy level (Rizov, 2004; 2005). Clearly, the local economy diversification would be combined with and contribute to the expansion of final demand of the households affected by the CAP subsidies, particularly Pillar 1 payments. The inter-sectoral spillovers, diversification and final demand channels, thus, lead to an outward shift in the firm demand function captured in the *Z*-vector.

According to equation (1), another effect of CAP payments on non-farm firm demand and employment could occur through the volatility of demand captured by the variance of demand σ^2; subsidies would generally reduce volatility of demand and thus, smooth employment adjustments.

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:

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

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:

$$Y = \min(S, D). \quad (3)$$

The medium-run optimization problem is

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

s.t. 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

[4] There could also be a second order, supply effects derived from 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 effects are controlled for in the estimation stage by firm characteristics such as size, age, and cost per employee which is also a measure of productivity.

scenarios – the case of capacity constraint and the case of unbounding capacity.[5] 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 regime, the adjustment of employment is inhibited, and the whole adjustment with respect to expected demand shifts falls on the price.

In the case of unbounding capacity, which, generally, is the most likely case in the UK market economy, optimal employment and price are 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. if demand exceeds supply:

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

The optimal price is determined by unit labour costs w/π_L and the mark-up is equal to the optimal probability of supply constraints on the goods market. The optimal 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

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

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

[5] For completeness, we have to point out that there could be a third scenario where 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 CAP and movement of labour laws. Given the setup of our framework the labour supply constraint is predetermined in short and medium run. Nevertheless, in our empirical analysis we use locational controls such as the rural-urban dummy and clustering at constituent country level as well as the sets of time and industry dummies which proxy for possible exogenous labour supply constraints.

where $\bar{\varepsilon}(\eta, \sigma)$ is the value of the demand shock which distinguishes the supply constrained regime from the demand constrained regime.[6] Demand shifts induced by the expansion of demand due to the spillovers and diversification impact of the 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 exhibits 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. As argued earlier, however, if the CAP payments reduce demand 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 and will form the basis of the estimating specifications in this study:

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

Thus, employment is a function of CAP payments as well as labour productivity, 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 controls capturing the effects of price elasticity of demand and market structure.

The framework outlined above is useful for the analysis of employment adjustment and price rigidities during the business cycle, in general, and the implications of the CAP payments, in particular. Suppose 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 capacity constraints (in boom periods), employment would remain unchanged and the firm would adjust the price. With sufficient capacities (in recession periods), the firm would adjust employment and the price would remain unchanged. The CAP payments resulting in sustained expansion and smoothing the demand and thus leading to larger firm capacities and more employment, in the long run would also make the probability of demand shocks hitting the capacity (supply constraint) lower.

[6] 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 $\bar{\varepsilon}$. Assuming a pdf of $\bar{\varepsilon}$ which is completely characterised by its expected value and its variance, it can be written as $\bar{\varepsilon}(\eta, \sigma)$.

The framework yields a further hypothesis about effects of the price elasticity of demand on the employment and price adjustment. In the case of demand shocks, a low price elasticity of demand $|\eta|$ should favour employment adjustments against price adjustments.[7] Finally, employment adjustment depends on 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, it is a question of the empirical analysis section.

Data and estimation strategy

The firm employment function formulated in equation (8) is estimated using the FAME data set of Bureau van Dijk combined with detailed subsidies data collected from DEFRA CAP Payments. 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 on more than 2,000,000 firms over the period 2008–2014. 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). The geographic distribution of the firms in the dataset which are available for analysis is presented in Figure 1.

- Figure 1 –

The subsidy data while partially available for all years from 2006 to 2014 is not complete for some years. This is to a great extent a result of amendments to the 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 data on individuals and partnership. Still the MSs were obliged to publish data on legal entities. In 2013 EU introduced new rules for transparency, including both individuals and legal entities. The only

[7] 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.

exception is 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 are withheld and replaced by a code number. The workable dataset available for this study covers four years: 2008, 2010, 2012, and 2014. The CAP information comprises amount of total subsidy and its three components: common market organisation (CMO) and direct payments (DP), under CAP's Pillar 1, and rural development (RD) payments under Pillar 2.

The industry sectors are identified on the basis of the current 2007 UK Standard Industrial Classification (SIC) at the 4-digit level. Given the large number of 4-digit industries, we work in several occasions, when defining specific variables, with the more aggregated 2-digit codes. All nominal monetary variables are converted into real values by deflating with the appropriate industry deflators taken from the ONS at 4-digit UK SIC level, when available, and at 2-digit level otherwise. Producer price index (PPI) is used to deflate sales and wages, and asset price deflators are used for deflating capital. We also use PPI for deflating CAP payments.

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 averaged over the 2005-2010 period are used. They are obtained from the OECD's I-O tables. The I-O shares are used as regression weights to allow for the inter-sectoral dependence affecting the transmission of the CAP expenditure effects to the non-farm sector firms.

For the regression analysis that follows we focus only on the full sample on SMEs, with less than 250 employees. Definition of variables and descriptive statistics calculated from the estimated sample of SMEs are reported in Table 3. Average firm characteristics are presented also for the SMEs by rural and urban locations in Table 4. Generally, there are no important differences in summary statistics between rural and urban firms. It is worth noting though that rural SMEs are slightly larger measured by employment but smaller in assets and face smaller aggregate demand. The cost of employees (and wages) also are lower in rural SMEs. In rural areas more CAP payments are received, exemplified by the higher share of direct payments in the total than in the urban areas.

- 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), is used. The GMM estimator controls for unobserved firm heterogeneity and 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.

Results

The estimation results from the SMEs sample, for two specifications with dependent variables log of employment and growth rate of employment respectively, are presented in Table 5.[8] As previously mentioned, in the estimations the I-O shares are used to weight each firm level observation, while the observations are also clustered at constituent-country-level to account for common policy environment by country. The estimated coefficients of all theoretically motivated control variables as per equation (8) are significant and with 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 appear small, they are of economic significance. The impact of 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 from the current level, ceteris paribus. Given our framework and considering that according to ONS statistics SMEs employed 15.6 million in 2015, a drop of 1.6 percent is equivalent to about 250,000 lost 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 accounts for a 20 per cent drop in the current annual employment growth rate, which is on average less than 1 per cent in our estimated sample.

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

Besides the effect of the CAP payments amount on employment levels and growth rates, the payments composition has also a statistically significant impact. Relative to other payment categories, SFPs (Pillar 1, CMO and DP) have a statistically significant stronger positive long term effect of about 5 per cent on employment level. There is no statistically significant differences in payment composition effects on employment growth. The finding that SFPs have a stronger impact on employment level than Pillar 2 payments is interesting and suggests that although decoupled in theory, they may affect the supply and demand (up- and down-stream) linkages between firms (and industries) which are associated with agriculture. Thus, the SFPs appear to be an important factor driving the CAP payments spillovers and local economy diversification 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. While broadly the effects of CAP transfers discussed above remain unchanged, even though somewhat weaker and of lower level of significance, we still find evidence of the CAP impact on non-farm jobs. The estimated coefficient of the interaction term in the employment level equation is statistically significant and its magnitude suggests that the long-term impact of CAP on employment is in fact concentrated in the rural SMEs sample, considering that the main CAP payments effect loses statistical significance. Furthermore, the rural dummy coefficient turned negative and remains significant suggesting that without the CAP payments employment in rural areas would be lower compared to urban areas. As said before, given out estimation framework and considering that according to ONS statistics rural SMEs employed over 2 million people in 2015, completely removing the CAP payments would lead to loosing 250,000 rural jobs. If indeed these lost jobs are mostly concentrated in the rural areas, the negative impact on the rural job market might 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 the CAP payments on employment. Whilst most of the previous studies 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. The estimated sample comprises about 200,000 firm-year observations and covers all industries in the UK economy. Two specifications of the employment function are estimated with employment level and growth rate respectively as dependent variables. The estimated sample consisted of SMEs only as these represent the majority of private businesses in the UK and in particular in rural areas.

The CAP has been subject to many criticisms by economists due to its market distorting effects, even after the decoupling of direct payments, and the blanket income support to farmers which attenuate their incentives to stay competitive and profitable without generous public transfers. However, this study found a positive effect of the CAP payments on non-farm employment, and in particular a strong positive effect of the SFPs. The interaction between CAP and rural areas also exerts positive effect on the level of employment. Under an extreme policy scenario where the CAP payments are completely removed, the impact on employment would amount to about 250,000 jobs lost. The statistical significance of the interaction term between CAP payments and rural areas suggests that the removal of the CAP payments is likely to have even broader rural development implications beyond the employment lost, e. g. a further outflow of population from rural areas, and in particular of young people wanting jobs outside farming.

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

Furthermore, the results should not be interpreted as an attempt to justify the continuation of SFP type of subsidies to the UK farmers, post-Brexit, as there might be other non-agricultural labour market policies which will be more efficient to increase employment opportunities in non-farm SMEs in the UK. However, this study sends the message that a broader approach is necessary in analysing the implications of the post-Brexit agricultural policy as the impact will be felt much beyond agriculture.

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Table 1: Some indicators of UK farming by constituent country (2013)

	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 (%)	40/44/10	5/78/17	10/24/66	5/68/27
Designated 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	Average 2010-2014
UK Total	*4337*	*4327*	*4433*	*4417*	*4299*	*4362.6*
Pillar 1	3424	3309	3348	3326	3234	3328.2
of which DP	3325	3304	3290	3285	3195	3279.8
MPC	99	5	58	41	39	48.4
Pillar 2 **	913	1018	1085	1091	1065	1034.4
of which EAFRD	512	653	742	752	798	691.4
England Total	*2761*	*2696*	*2777*	*2792*	*2714*	*2748*
Pillar 1	2199	2099	2146	2126	2048	2123.6
of which DP	2100	2094	2088	2085	2009	2075.2
MPC	99	5	58	41	39	48.4
Pillar 2 **	562	597	631	666	666	624.4
of which EAFRD	348	448	470	532	563	472.2
Wales Total	*413*	*417*	*426*	*406*	*413*	*415*
Pillar 1 DP	316	312	309	309	301	309.4
Pillar 2 **	97	105	117	97	112	105.6
of which EAFRD	38	45	54	48	54	47.8
Scotland Total	*779*	*826*	*840*	*819*	*757*	*804.2*
Pillar 1 DP	589	583	584	583	566	581
Pillar 2 **	190	243	256	236	191	223.2
of which EAFRD	92	123	167	113	119	122.8
Northern Ireland Total	*384*	*388*	*390*	*400*	*415*	*395.4*
Pillar 1 DP	320	315	309	308	319	314.2
Pillar 2 **	64	73	81	92	96	81.2
of which EAFRD	34	37	51	59	62	48.6

Source: Agriculture in the United Kingdom 2014.

* 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 co-financing

Table 3 Definition of variables and summary statistics

Variable	Definition	Mean (S.D.)
Employment	Number of the firm full-time equivalent workers, log	3.07 (1.50)
Employment growth	Growth rate of firm employment	0.01 (0.23)
Market demand	Annual 2-digit SIC and TTWA aggregate demand in thousands GBP, log	13.83 (3.41)
Demand variance	Firm revenue deviation rate from industry 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 CMO subsidy, Pillar 1	0.04 (0.11)
DP share	Share of direct payments (DP), Pillar 1	0.67 (0.41)
RD share	Share of rural development payments (RD), Pillar 2	0.29 (0.39)
SFP share	Share of single farm payments (SFP=CMO+DP), Pillar 1	0.71 (0.39)
Manufacturing	Dummy indicating manufacturing industries	0.12 (0.33)
Construction	Dummy indicating construction and utilities industries	0.09 (0.28)
Services	Dummy indicating service industries	0.79 (0.41)
Rural area	Dummy indicating rural areas according to the DEFRA (wider) definition of rurality	0.17 (0.38)

Notes: Total number of observations is 190,348 over four time periods, 2008, 2010, 2012, and 2014.

Table 4 Summary statistics for the rural and urban samples

Variable	Rural mean (sd)	Urban mean (sd)
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 subsidies	9.08 (1.79)	8.71 (1.78)
DP share	0.76 (0.34)	0.66 (0.42)
RD share	0.22 (0.33)	0.30 (0.40)
CMO share	0.02 (0.09)	0.04 (0.12)
SFP share	0.78 (0.33)	0.70 (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

Notes: Mean and standard deviation in parentheses are reported.

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)****
SFP 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)***
SFP share	**0.044 (0.008)****	**0.009 (0.010)**
Total subsidy*Rural area	**0.120 (0.060)***	**0.037 (0.037)**
Rural area	-0.386 (0.163)*	-0.032 (0.033)
2010	-0.111 (0.009)**	-0.024 (0.004)**
2012	-0.170 (0.010)**	-0.012 (0.010)
2014	-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.

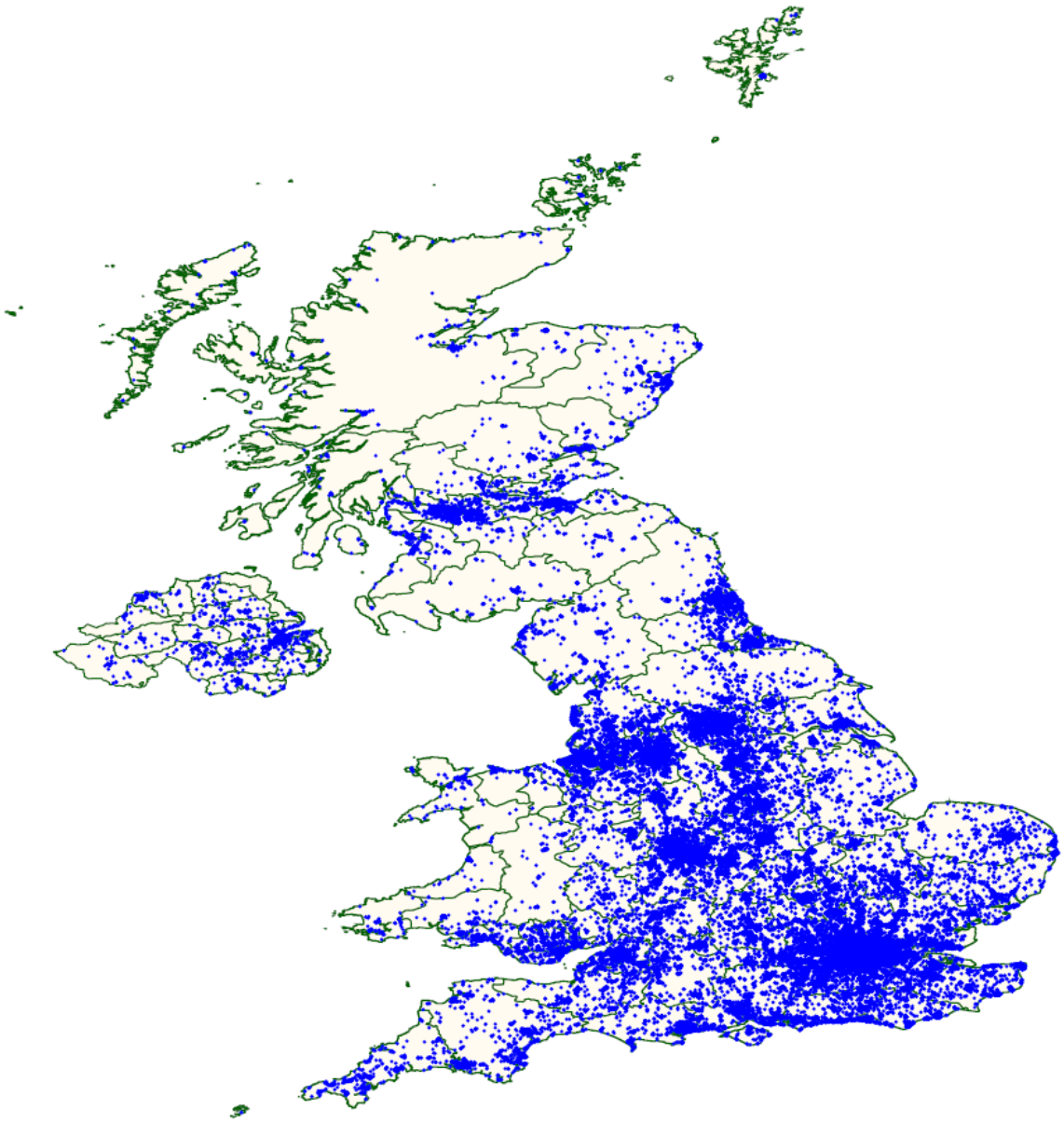

Figure 1 Firm sample geographic distribution in the UK