Does Common Agricultural Policy Reduce Farm Labour Migration? A Panel Data Analysis Across EU Regions

ALESSANDRO OLPER
alessandro.olper@unimi.it

VALENTINA RAIMONDI
valentina.raimondi@unimi.it

DANIELE CAVICCHIOLI
daniele.cavicchioli@unimi.it

MAURO VIGANI
mauro.vigani@unimi.it

Paper prepared for presentation at the EAAE 2011 Congress
Change and Uncertainty
Challenges for Agriculture,
Food and Natural Resources

August 30 to September 2, 2011
ETH Zurich, Zurich, Switzerland

Does Common Agricultural Policy Reduce Farm Labour Migration? A Panel Data Analysis Across EU Regions*

Alessandro Olper
University of Milano & LICOS

Valentina Raimondi
University of Milano

Daniele Cavicchioli
University of Milano

Mauro Vigani
University of Milano

September 2011

Abstract

This paper deals with the determinants of labour out-migration from agriculture across 153 EU regions over the 1990-2008 period. The central aim is to shed light on the role played by CAP payments on this important adjustment process. Using static and dynamic panel data methods, we show that standard neo-classic drivers, like the relative income and the relative labour share, represented significant determinants of the inter-sectoral migration of the agricultural labour. Overall, CAP payments have contributed significantly to job creation in agriculture, although the magnitude of the economic effect is quite small. Moreover, Pillar I subsidies have exerted an effect from three to five times stronger than Pillar II payments.

JEL codes: Q12, Q18, O13, J21, J43, J60.

Keywords: Out-farm Migration, Labour Markets, CAP Payments, Panel Data Analysis.

* A. Olper is associated professor at the Università degli Studi di Milano; V. Raimondi, D. Cavicchioli and M. Vigani are, respectively, researchers and PhD student at the Università degli Studi di Milano.
Corresponding author: Alessandro Olper, e-mail: alessandro.olper@unimi.it.
Financial support received from the European Commission FP7 Project 'Factor Markets', is gratefully acknowledged.

1. Introduction

In the last fifty years European countries' agricultural sector experienced dramatic adjustments in their labour markets, showing an impressive out-migration of the agricultural labour force. Try to understand how the common agricultural policy (CAP) has affected this process, represents an important policy issue rarely investigated from an European-wide perspective (Shucksmith *et al.*, 2005).

Was the CAP effective in keeping labour force in agriculture, or, differently, it played a poor job ? In times of growing budget pressure and high unemployment rates across EU member states, try to answer this question appears a fundamental step for future CAP reforms. To maintain and create jobs in agriculture and rural areas has been a traditional (*indirect*)[1] objective of the CAP, an objective recently re-stated and emphasized by several EU's official documents (see, e.g., European Commission, 2010; European Parliament, 2010).[2]

Current evidence on the effect of farm policies on farm labour allocation can be classified into two broad categories (see Glauben *et al.*, 2006). Empirical studies at farm-household level based on micro-data (e.g. Woldehanna *et al.*, 2000; Ooms and Hall, 2005; Ahearn *et al.*, 2006; Hennessy and Rehman, 2008; Douarin, 2008); studies focusing on the farm labour (re)allocation at aggregate country and/or regional level (e.g. Barkley, 1990; Breustedt and Glauben, 2007; D'Antoni and Mishra, 2010; Petrick and Zier, 2011). Our paper falls within this second strand of literature.

Especially due to data limitations, actual evidence on the effect of CAP subsidies on off-farm labour migration, other than quite inconclusive, is largely confined to specific country or regional case studies (Petrick and Zier, 2011). Although interesting and often rich of detailed interpretations, such studies measure the CAP effects within a single country or region. This approach has the advantage of keeping fixed many factors like institutions, and circumvent problems associated to cross-country/region analyses. However, these findings are difficult to generalize to other countries and regions that have wide differences in development, labour market institutions and farm structure. Until now, the lack of comparable and consistent data on the CAP payments at EU regional level, has prevented researchers from adopting an approach that takes into account both cross country/region observable and unobservable characteristics.[3]

The main objective of this paper is to offer a preliminary contribution that moves in that direction. Specifically, the paper investigates the effect of CAP payments on inter-sectoral labour reallocation, extending previous studies in three main directions. First, our analysis has a broad coverage, considering 153 EU regions over the period from 1990 to 2008. Second, the effects of CAP instruments are analyzed focusing on both Pillar I

[1] Indirect because, although 'maintain (and create) jobs in agriculture and rural areas' was not an initial explicit objective of the CAP, the large emphasis given to the 'income support', implicitly may leads to a reduction of off-farm labour migration, *ceteris paribus*. See Section (2) for details.

[2] The European Commission reflection about the future of the CAP - 'The CAP Toward 2020' (EC, COM(2010) 672) - explicitly addressed agricultural and rural labour issues in several sections of the document. Labour and rural areas employments issues are also well represented in the recent European Parliament document on the CAP reforms - 'On the Future of the CAP after 2013' (EP 439.972).

[3] A notable exception is the paper of Esposti (2007), who investigated the effect of CAP Pillar I payments on economic growth and convergence across EU regions over the 1989-2000 period.

payments (coupled and decoupled), and on several Pillar II rural development instruments. Indeed, with the exception of Petrick and Zier (2011), who studied the entire portfolio of CAP measures, previous analyses have normally considered only one instrument at a time. Third, we rely on modern panel data methods, estimating both static and dynamic migration equations, in order to account for several identification issues, like heterogeneity and dynamics. Finally, we deliver a back-of-the-envelope calculation of the net benefits of the CAP in terms of farm job creation.

Overall, we identify positive causal effects of the CAP on job creation in agriculture. In our preferred specification and procedure, we estimate a long-run elasticity of out-farm migration to overall CAP subsidies of about –0.16. However, this average value masks substantial heterogeneity across policy instruments. Indeed, while we do not detect significant differences between coupled and decoupled payments, strong differences emerged by comparing Pillar I vs. Pillar II measures, where the former shows an effect of about two time stronger than the later. Finally, a back-of-the-envelope calculation, based on our preferred specifications, suggests that, on average, the cost of keeping a worker in agriculture is about 27.000 €.

The remainder of the paper is organized as follows. The next section provides our conceptual framework and the empirical strategy. Section 3 describes the data and how we measure the CAP payments at EU regional level. In Section 4 the results are presented and discussed. Finally, Section 6 concludes.

2. Conceptual model and empirical strategy

3.1 Out-farm migration equation and measurement problems

The paper is empirical in nature. However, to rationalize our empirical work, we rely on the theory of occupational choice and labour migration decision, that have the roots in the Todaro's two-sectors model (Todaro, 1969), subsequently developed by Mundlak (1979).

Following Barkley (1990), consider an individual facing a given return in two mutually exclusive occupations *i*, say agriculture (*i*=1) and non-agriculture employment (*i*=2). The choice of the occupation is determined by comparing the discounted utility derived from job over his/her career. A worker of age *g* that retires at time *T* will face an optimization problem as described in equation (1), where *r* is the discount rate

$$H_{ik} = \int_g^T e^{-rt} V(X_{it}, L_{it}) dt - \int_g^T e^{-rt} V[(X_{jt}, L_{jt}) - C_{ijt}] dt \tag{1}$$

with $X_{it} = q_{it} w_{it} L_{it}$.

Utility in the period *t* is a function of both consumption (X_{it}) and hours of work spent in the job (L_{it}). Migration of an individual from one occupation to another occurs when the expected utility derived from a potential profession rise above the utility expected in the current job, at the net of the costs incurred to change profession (C_{ijt}). We assume that agriculture *i* is the current occupation, and *j* is some other non-agricultural occupation. Migration from *i* to *j* will occur when the net utility is negative ($H_{ik} < 0$).

Although the return to labour may be higher in non-agricultural occupation than in farming, an agricultural worker involved in job search may discount the higher wage rate

(w_j) by the probability (q_j) of obtaining employment in non-agricultural sector. For that reason, the migration from agriculture to other sectors does not occur instantaneously.[4]

A potential migrant has to estimate the probability of obtaining a job in the industrial sector, to calculate H_{ik}. Clearly, this probability is affected by macroeconomic conditions, like unemployment rate and the relative size of the sectoral labour forces. Other things being equal, the larger the non agricultural labour market, the easier it should be to obtain a job there. However, as most of the migrations are out of agriculture, the migration will increase with the size of the labour force in agriculture (Larson and Mundlak, 1997). Moreover, economic conditions in the agricultural sector, like government payments or the structure of the family farm, are also expected to affect the migration rate out of agriculture.

The migration of individual k occurs if $H_{ik} < 0$. An index function f_{ik} is used to separate migrants from non-migrants: $H_{ik}\ f_{ik} \leq 0$ where $f_{ik} = 1$ if $H_{ik} < 0$ (migration occurs), $f_{ik} = 0$ if $H_{ik} \geq 0$ (migration does not occur). This index function allows for the aggregation of individual migrants by the summation across f_{ik}. The gross migration rate M_{ij} from occupation i to occupation j, will be

$$M_{ij} = \sum_{k=1}^{I} f_{ik}, \tag{2}$$

where I are people employed in occupation i.

Because of people flow from one sector to another and *vice-versa*, the net out migration from agriculture can be defined as $m = M_{ij} - M_{ji}$. Due to data limitation, migration flows in both directions are not observable. Thus, previous empirical applications measured out-farm migration simply as the growth rate in agricultural employment from one year to the next, disregarding the dynamic in the total labour force (e.g. D'Antoni and Mishra 2010). This approach can be a reasonable approximation when the exercise is conducted within a single country. However, working across EU regions, as in the present study, disregarding the differences in the total labour force dynamic at regional level, can introduce a systematic bias in the inter-sectoral labour migration estimates.

To reduce this potential source of bias, the approach of Larson and Mundlak (1997) has been followed, where it is assumed that, without migration, labour in agriculture and non-agriculture would grow at the same rate as the total labour force. Deviation from this rate are attributed to migration. Formally, the net migration rate is estimated as

$$m = [L_{1t-1}(1+n) - L_{1t}]/L_{1t-1}, \tag{3}$$

where $n = (L_t - L_{t-1})/L_{t-1}$ is the growth rate of the total labour force.

Finally, note that this definition of farm out migration does not take into account the part-time farming, that has become an important characteristic of the EU agricultural

[4] Note that the return to labour in this model works as summary statistics, in the sense that structural parameters like the substitutability of capital for labour, the (low) income consumption elasticity of farm products, and the productivity growth rate, are supposed to affect the migration rate only through their effect on the relative returns to labour in the farm and non-farm sectors. For a two sectors growth model with farm-non-farm wage gap, that explicitly consider these structural parameters, see Dennis and Iscan (2007).

labour market. Hence, using equation (3) potentially leads to an heterogenous underestimation of the labour out-migration, as part-time farming differs significantly across the EU regions. Thus, our empirical strategy has to be robust to this and others kind of regional heterogeneity.

3.2 Econometric approach

Armed of this simple theoretical logic and following previous works, the rate of out-farm migration *m* is expected to be, primarily, a function of the relative per-capita income between non-farm and farm activities (*RI*), and all other factors affecting the costs incurred to change profession (*C*).

Our main goal is to isolate the effect of the CAP on the rate of out-farm migration. Following the model's logic, to the extent to which CAP subsidies (*S*) are effective in transferring income to farmers, then their effect should reduce the farmers propensity to migrate in another sector, *ceteris paribus*. The rate of out-farm migration of the EU region *i* at time *t* can be explained by the following benchmark empirical equation:

$$m_{it} = \beta_0 + \beta_1 RI_{it-1} + \beta_2 S_{it-1} + Z_{it-1} + \nu_{it}, \quad (4)$$

where ***Z*** is a vector including all other observable factors like the relative labour share, the unemployment rate and the farm and farming characteristics, that affect the migration costs *C*. The error term $\nu_{it} = \alpha_t + \mu_i + \varepsilon_{it}$, comprises time fixed effects common to all regions α_t, time-invariant regional fixed effects μ_i, and a time-varying component ε_{it}.

By including time and regional fixed effects, equation (4) is equivalent to a difference-in-difference (D-in-D) regression model. Note that, the use of time and, especially, regional fixed effects are of particular importance for our identification assumption. Indeed, the fixed effects control for both observed and unobserved (regional) heterogeneity, rendering the assumption of exogeneity of our right-hand side variables more credible. This consideration is of vital importance to properly identify the average effect of the CAP payments on regional out-farm migration. Indeed, the inclusion of fixed effects controls for (time invariant) observable and unobservable differences in the unit of observations, like the stock of human capital, the age structure of the farm population, or the share of land under property. These are all variables that can affect the farmer decision to migrate, but that change very slowly over time.

About the identification of the CAP effect, note that the inclusion of fixed effects does a good job in resolving endogeneity bias due to regional heterogeneity and/or selection bias. Hence, using (4) the key identification assumption is that the policy variable, S_{it}, is not simultaneously determined with the regional rate of out-farm migration, m_{it}.

Different arguments justify this assumption. First, because we work at EU regional level, it appears plausible to assume that Pillar I payments are exogenous to migration, given that these policies are decided at the EU centralized level. In principle, this assumption may be more questionable when Pillar II payments are considered. In fact, in this case the policy making process is also under the responsibility of EU regional institutions (Petrick and Zier, 2011), and this may generate a potential problem of endogeneity bias due to political economy motives. However, the degree of freedom of regional governments to allocate money of Pillar II, affects only the equilibrium between different Pillar II measures (and axis), but not their aggregated level. Indeed, the overall amount of Pillar II expenditure is predetermined through a bargaining process at EU and national level. Finally, because it is plausible to assume that the farmer's choice to exit at time *t* is affected by the level of CAP support at time *t*-1, in equation (4) the term *S* is always included as lagged of one year, thus treated as a predetermined variable.

A concern of using equation (4) is its static nature. Indeed, both D'Antoni and Mishra (2010), for the US, and Petrick and Zier (2011), for three East German Lander, showed that 'dynamics' considerations may be important in studying the effect of farm subsidies on out-farm migration.[5] To tackle with this issue we estimate also a dynamic autoregressive specification

$$m_{it} = \beta_0 + m_{it-1} + \beta_1 RI_{it-1} + \beta_2 S_{it-1} + Z_{it-1} + \mu_i + \alpha_t + \varepsilon_{it} \,. \tag{5}$$

Given the large cross-sections and the short time series of our data set, the correlation between the lagged dependent variable and the transformed error term renders the least squared within estimator inconsistent. To avoid this inconsistency, Arellano and Bond (1991) proposed a Generalised Method of Moments (GMM) estimator as an alternative to the within estimator. They suggest to transform the model into a two steps procedure based on first difference to eliminate the fixed effects, as a first step. Hence, the first-differenced equation will be

$$\Delta m_{it} = \alpha \Delta m_{it-1} + \beta_1 \Delta RI_{it-1} + \beta_2 \Delta S_{it-1} + \Delta Z_{it-1} + \mu_t + \Delta \varepsilon_{it} \,. \tag{6}$$

Next in a second step, the lagged difference of the dependent variable in (6) is instrumented using lagged differences and levels of the dependent variable.

4. Data

The sample used for the empirical analysis covers 153 regions of the 15 European Union countries, over the period 1990-2008. Table 1 describes the number of regions used for each country, according to the Nomenclature of Statistical Units (NUTS) and distinguishing between the NUTS1 and NUTS2. The choice to utilize both NUTS1 and NUTS2 is motivated by the necessity to link data from different sources. Indeed the 'Farm Accountancy Data Network' (FADN) regional classification does not always match with the NUTS2 level defined by Eurostat.[6]

Our dependent variable is the net migration rate, obtained as described in equation (3). To calculate migration, we should use data on labour starting from census data. Unfortunately such data are available every ten years and can be transformed as annual series only with interpolations. Thus, due to data limitation, we are forced to use

[5] Specifically, D'Antoni and Mishra (2010) showed that to move from a static to a dynamic autoregressive specification, matters for the final results. Differently, Petrick and Zier (2011) reported evidence of persistent lags structure for some CAP instruments.

[6] An alternative solution is to apply the FADN information at NUTS1 also for those NUTS2 regions where the FADN data is lacking. However, because our empirical strategy exploits especially the within region variation in out-farm migration and CAP payments, following this approach does not add substantial 'new' information to the model structure.

employment data to measure annual migration at the EU regional level. As highlighted by Butzer *et al.* (2003), these data present two sets of problems: first, they bring the demand for workers into the migration series; second they tend to be more erratic. Nevertheless the trend still prevails.

The inter-sectoral income differential is measured by the ratio of income in non-agriculture to that in agriculture (*RI*). Income is calculated as Gross Value Added (GVA) per worker, at constant and basic prices. For non-agriculture sector we used the difference between total GVA and GVA in agriculture, as well as for non-agricultural employment.

The relative labour force (*RL*) is calculated as the ratio of employments in the non-agricultural sector to that in agricultural sector. The measure of population density, is calculated as the population ratio to regional area in Km^2. Information on population, regional area, unemployment rate, total and sectoral GVA and employment, at the level of NUTS2 and NUTS1 regions, come from the Cambridge Econometric's Regional Database.

Finally, farm family worker is represented by the number of family members working in the farm, and comes from FADN database.

4.1 Policy data

Given our specific focus on the effect of CAP payments on out-farm migration, the way we measure the policy variables at regional level is a critical question, due to the well known lack of official data. Previous studies have basically followed two different approaches: measuring a regionalized producer subsidy equivalent (PSE) as in Anders *et al.* (2004) and Tarditi and Zanias (2001); using the Farm Accountancy Data Network as in Shucksmith *et al.* (2005), and by combining the same source with Eurostat Regio-New Cronos database, assuring to the former also a time variation, as in Esposti (2007).

In theory, the last approach is the most suited for our analysis, where the econometric identification has to be based on the within region variation in CAP payments. Unfortunately it has two main shortcomings. First, Eurostat does not provide time series data at regional level for all EU countries[7]. Second, and more important, Eurostat data, based on agriculture sectoral series, do not incorporate decoupled subsidies after 2005. Their use would then reduce the time coverage of the analysis, and would preclude the possibility of investigate the possible differentiated effect between coupled and decoupled payments, as well as the effect of Pillar II policy.

To overcome the issues above, we adopted a new strategy measuring CAP payments starting from the FADN data at regional level. For every region covered by the FADN, we have indeed the amount of payments received by the average farm over the period 1990-2008. To the extent to which the average farm is representative of the farm population,[8] the computation of the ratio between such farm CAP payments and the

[7] Esposti (2007) resolves this issue by applying the growth rate at the higher aggregation level (NUTS 1) to those (NUTS 2) regions whose Eurostat data are lacking.

[8] For each region, the FADN sample is stratified according to the Type of Farming (TF) and the Economic Size Unit (ESU) class, while the same stratification is made on the regional farm population; each stratum in the sample is then weighted to render its data representative of the underlying population. Such

respective farm net income (inclusive of subsidies), offers the possibility to measure a consistent regional level of farm protection due to CAP policies.

Note that this approach is fully consistent with previous empirical exercises conducted on the US out-farm migration (see Barkely, 1990; D'Antoni and Mishra, 2010), where the effect of government payments is measured using the ratio between farm subsidies to the farm value added at aggregated (country) level.

A further advantage of our approach is the possibility of disentangle CAP total payments in their different components (Pillar I and Pillar II). Specifically, we can distinguish between coupled and decoupled payments of Pillar I, and include agri-environmental payments, less favoured areas (LFA), investment aids and a residual category called 'other' subsidies of Pillar II[9]. Note that some of the latter payments were introduced before Agenda 2000, thus the 'Pillar II' expression could be not fully correct. Nevertheless, we chose to use it to clearly and easily distinguish between CAP market subsidies and CAP structural policies.

Finally, a potential limitation of our policy variable is that it does not capture the 'price support' component of CAP transfers, a component that was in place at a decreasing rate until 2003. However, it is important to note that the price component of CAP protection in our empirical model is implicitly controlled by the relative income variable, *RI*.

5. Econometric results

Table 3 reports the static D-in-D estimate of equations (4). The specifications differ with respect to how the policy variables are considered. Following, D'Antoni and Mishra (2010), Augmented Dickey Fuller (ADF) tests were used to determine whether the data were stationary.[10] All variables, with the exception of relative labour and unemployment rate, were found stationary. Thus these two variables were introduced in first difference in the final D-in-D specification.

In line with the labour migration model, the relative income between non-farm and farm sector exerts a positive and significant effect on the level of out-farm migration (*p*-value < 0.01). The estimated elasticity equals 2.5. Thus, even if such value is smaller than the one estimated by Butzer *et al.* (2003) for Thailand, Philippines and Indonesia (equal to 10, 6 and 7, respectively) as well as those estimated by Barkely (1990) for the US (equal to 4.5) it lies in the same order of magnitude. Our lower estimated elasticity suggests that at EU regional level, out-farm migration is less responsive to income differences. The changes in the relative labour force were also significant and positive. As suggested by Larson and Mundlack (1997), this ratio reflects the absorptive ability and the opportunity of employment in the non-farm sector.

Among the other covariates, only the average population density has a significant effect on out-farm migration, although its negative sign is contrary to our expectation.

---

procedure makes FADN data representative at regional level for TF and ESU and, indirectly, for Pillar 1 payments, while the same may not be assured for Pillar 2 payments.

[9] Pillar I includes: 'total subsidies on crops', 'total subsidies on livestock' and 'decoupled payments'. Pillar II includes: 'total support for rural development' and 'subsidies on investments'.

[10] Specifically, given the unbalanced panel structure of our dataset, use was made of the Maddala and Wu (1999) ADF test for unbalanced panel data.

The family workers have the expected negative sign, while the effect of a change in the unemployment rate is unexpectedly positive. However they are both always insignificant.

Moving to the variable of interest, CAP subsidies, Column 1 of Table 3 considers the total level of CAP payments (Pillar I plus Pillar II) as policy variable. Its estimated coefficient is negative and significant at 1% level. Thus, in general, the CAP played a role in keeping labour within agriculture, *ceteris paribus*. This result is similar to the finding of D'Antoni and Mishra (2010) for the US economy, but it goes in an opposite direction as for the paper of Petrick and Zier (2011), who showed that with the exclusion of agrienvironmental payments, CAP subsidies significantly increase out-farm migration in three Eastern German Landers.

The subsequent regressions in Table 3 display results considering the CAP policy instruments separately. Note that we have been forced to conduct the analysis of Pillar I and Pillar II policies in isolation, as the two series are strongly collinear.[11] Considering first Pillar I payments, the estimated policy coefficient is again negative and strongly significant, both in isolation (column 2), and when the effect between coupled and decoupled subsidies is splitted (column 3).

Columns (4) and (5) show results for Pillar II policies. Also this group of measures, taken as a whole, points to a negative out-farm migration effect, although this effect is heterogeneous across instruments. Splitting Pillar II policies, we find that money directed to agrienvironmental measures and to less favoured areas (LFA) significantly contributes to job creation in agriculture. Differently, investments aids have a positive effect on out-farm migration, while other Pillar II measures have a negative effect, although both are statistically insignificant. Broadly speaking, the results of Pillar II policy are more in line with the findings of Petrick and Zier (2011). Finally, in the D-in-D specification we do not find any clear effect of a policy shock due to the 2003 Fischler reform. Indeed the dummy equal to 1 from 2005 onward (0 otherwise) is never significant.[12]

Next, Table 4 introduce dynamic in the specification, by the estimation of an autoregressive specification using a difference-GMM estimator. This strategy should shed further light on the robustness of our findings. First, the bottom of Table 4 reports standard tests to check for the consistency of the GMM estimator (see Roodman, 2009). The Arellano-Bond test for autocorrelation indicates that second order correlation is not present. On the contrary, the presence of first order serial correlation suggests that the OLS estimator is inconsistent. Moreover, the standard Hansen test confirms that in all cases our set of instruments is valid.

The autocorrelation coefficient is significant and negative, although its magnitude is quite low (< 0.1). A negative autocorrelation coefficient suggests that if migration is high at time *t*-1, then it will be lower at time *t*. This result is consistent with the adjustment process under study.

[11] We also ran a regression that includes Pillar I and Pillar II payments together, and we observed a strong reduction in the magnitude of both estimated coefficients and their significance level. On the contrary, when included separately, they are always strongly significant. The correlation coefficient between the two series is indeed quite high, and equal to 0.50.

[12] However, a closer inspection of the year fixed effects showed that, when we add the Fischler reform dummy, the year fixed effects for 2005 and 2006 turns out to be positive and significant at 5% level, indicating some sort of positive out-migration effect of the Fischler reform. Other dummies for policy reforms of the ninety were also found to be never significant.

In general, the results of the dynamic specification are similar to the static ones, although some difference are worth noting. First, the relative labour negatively affects the migration rate and it is strongly significant. A possible interpretation is that countries tend to converge to similar levels of non-agricultural and agricultural labour ratio. Second, and in line with the *a priori* expectation, in the dynamic model the unemployment rate affects negatively the rate of out-farm migration. Third, the population density is never significant. Finally, and interestingly, the dummy for the introduction of decoupling (equal to 1 from 2005 onwards) now turns out to be negative and significant in all the specifications, but the one where the Pillar I is splitted in coupled and decoupled payments (see column 3). This result is puzzling, because on the one hand it seems to suggests that the Fischler reform represented a policy shock also from the point of view of the farmers decision to exit from the agricultural sector. On the other hand, as we will show later, we do not detect any relevant difference in the migration effect between coupled and decoupled payments.

Moving to the policy variables of interest, their estimated coefficients are always negative and significant, giving a broad confirmation to the D-in-D results. Considering first Pillar I policies (columns 2 and 3) the magnitude of the estimated coefficients is slightly lower (in absolute value) than the corresponding static estimates reported in Table (3). This result is not surprising, because now their coefficients capture short-run effects. However, the picture changes somewhat when the policy variables considered are those related to the Pillar II. In that case (see columns 4 and 5), the absolute magnitude of the coefficients slightly increases passing from the static to the dynamic specification.

What does all this means from an economic point of view? Consistent comparison between the job creation effect of CAP policies can be made on the basis of their respective elasticities (see Table 5). Several interesting patterns emerged. First, a 1% increase in total CAP payments decreases out-farm migration of about 0.121% using the D-in-D estimator, a value that rise to 0.159% when dynamic is accounted for. Thus, in general, the magnitude of the economic effect is rather small, but it increases of about 30% using the GMM estimator. This conclusion hold for all the CAP payments considered. Thus, the comparison of the long-run elasticity across estimators sheds some light on the potential estimation bias in using the static model.

However, the average effect cancel out heterogeneity across CAP instruments. Indeed, the long-run elasticity of Pillar I payments (equal to -0.165), is about two times higher in absolute value than the elasticity of Pillar II policies (equal to -0.094). Moreover, the differences across Pillar II instruments are striking, and in line with common intuition. In fact, LFA payments elasticity (equal to -0.102) is more than 2.4 times higher in absolute value than agri-environment payments elasticity (-0.043). Finally, and interestingly, we do not detect any significant differences in the elasticity between coupled and decoupled Pillar I payments, a result not new in the literature (see Ahearn et al. 2006; Corsi, 2008).

Finally, with our estimates at hand and based on a back-of-the-envelope calculation, we may infer whether the CAP was effective in keeping labour in agriculture. Using results from column (1) of Table 4, on the overall CAP effect on out-farm migration, we estimated that to maintain one worker in agriculture taxpayers spent, on average, 27.000 € per year. This value is close to the average salary in the old member states, suggesting that the cost of keeping a worker in agriculture, through the CAP, has been very high, at least if we disregard the potential positive externalities provided by farmers' activities.

6. Conclusions

Understanding the effect of CAP policies is important because a deeper comprehension of their incidence may allow to design better policies. This paper gives a contribution in that direction studying how different CAP instruments have affected job creation in agriculture across 153 EU regions over the period 1990-2008.

By the exploitation of the within and across-region variation in the out-farm migration and CAP policies, and using both static D-in-D and dynamic GMM panel data methods, we find robust evidence that the CAP has played a role in keeping labour force in agriculture. Among CAP instruments, we show that Pillar I payments are, so far, the most effective in reducing out-farm migration, while the effect of Pillar II payments is conditional to the instruments considered. Moreover, we do not detect any significant difference on job creation between coupled and decoupled payments.

By answering to the initial question 'whether the CAP was effective in keeping labour force in agriculture', we find that using the CAP, the cost to maintain a farmer in agriculture corresponds, on average, to his salary itself. So it seems that there is no light at the end of the tunnel, *ceteris paribus*.

References

Ahearn, M.C., El-Osta, H., Dewbre, J. (2006). The impact of coupled and decoupled government subsidies on off-farm labour participation of U.S. farm operators. *American Journal of Agricultural Economics* 88, 393–408.

Anders, S., Harsche, J., Herrmann, R. and Salhofer, K. (2004). Regional Income Effects of Producer Support under the CAP. *Cahiers d'Economie et Sociologie Rurales*, 73,103-121.

Arellano, M., Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and application to employment equations. *Review of Economic Studies* 58, 227–297.

Barkley, A. P. (1990). The Determinants of the Migration of Labour out of Agriculture in the United States, 1940-85. *American Journal of Agricultural Economics*, 567-573.

Besley, T., Case, A. (2000). Unnatural experiments? Estimating the incidence of endogenous policies. *Economic Journal* 110, F672–F694.

Breustedt, G. and Glauben, T. (2007). Driving Forces behind Exiting from Farming in Western Europe. *Journal of Agricultural Economics*, 58(1), 115-127.

Butzer, R., Larson, D. and Mundlak, Y. (2003), Intersectoral Migration in Southeast Asia. Evidence from Indonesia, Thailand, and the Philippines. *Journal of Agricultural and Applied Economics*, 35, 105-117.

Corsi, A. (2008). Impacts of the 2003 CAP Reform on Pluriactivity and on Labour Markets, in Cristoiu, A. and J. Curtiss (eds.), Income and Factor Markets under the 2003 CAP Reform - Workshop Proceedings, European Commission, Joint Research Centre, Seville, 2007.

D'Antoni, J. and Mishra, A. K. (2010). Agricultural Policy and Its Impact on Labour Migration from Agriculture, Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Orlando, FL, February 6-9, 2010.

Dennis, B.N. and Iscan, T.B. (2007). Productivity growth and agricultural out-migration in the United States, *Structural Change and Economic Dynamics,* 18, 52-74.

Douarin, E. (2008). De Decoupled Payments Really Encourage Farmers to Work More Off-farm? A Micro-level Analysis of Incentives and Preferences. Paper prepared for presentation at the 12th Congress of the EAAE, Ghent, Belgium, August 26-29, 2008.

Esposti, R. (2007). Regional growth and policies in the European Union: Does the Common Agricultural Policy have a counter-treatment effect? *American Journal of. Agricultural Economics,* 89, 116–134.

European Commission, Directorate-General for Agriculture and Rural Development, (2010). Europeans, agriculture and the Common Agricultural Policy. Special Eurobarometer 336.

European Parliament, Committee on Agriculture and Rural Development, (2010). On□the□future□of□the□Common□Agricultural□Policy□after□2013. EP 439.972.

Glauben, T., Tietje, H. and Weiss, C. (2006). Agriculture on the Move: Exploring Regional Differences in Farm Exit Rates in Western Germany. *Jahrbuch fur Regionalwissenschaft* 26, 103-118.

Ahearn, M. C., El-Osta, H. S., and Dewbre, J. (2006). The Impact of Coupled and Decoupled Government Subsidies on Off-Farm Labour Participation of U.S. Farm Operators. *American Journal of Agricultural Economics*, 88, 393-404.

Hennessy, T.C. and Rehman, T. (2008). Assessing the Impact of the 'Decoupling' Reform of the Common Agricultural Policy on Irish Farmers' Off-farm Labour Market Participation Decisions. *Journal of Agricultural Economics,* 59(1), 41-56.

Larson, D. and Y. Mundlak. (1997). On the Intersectoral Migration of Agricultural Labour. *Economic Development and Cultural Change*, 45 (January 1997), 295-319.

Maddala, G.S. and Wu, S. (1999). A Comparative Study of Unit Root Tests With Panel Data and A New Simple Test. *Oxford Bulletin of Economics and Statistics,* 61, 631-652.

Mundlak, Y. (1979). *Intersectoral factor mobility and agricultural growth.* Washington: International Food Policy Research Institute.

Ooms, D.L. and Hall, A.R. (2005). On- and Off-farm Labour Supply of Dutch Dairy Farmers: Estimation and Policy Simulations. Paper prepared for presentation at the 11th Congress of the EAAE, Copenhagen, Denmark, August 24-27, 2005.

Petrick, M. and Zier, P. (2011). Regional employment impacts of Common Agricultural Policy measures in Eastern Germany: a difference-in-differences approach. *Agricultural Economics*. (In press).

Roodman, D., (2009). How to do xtabond2: an introduction to difference and system GMM in Stata, *Stata Journal*, 9(1), 86-136.

Smith, R., Blundell, R. (1986). An exogeneity test for a simultaneous equation tobit model with and application to labour supply. *Econometrica,* 54: 679–685.

Shucksmith, M., Thomson, K.J., Roberts, D. (Eds.) (2005). *The CAP and the Regions. The Territorial Impact of the Common Agricultural Policy*. CABI, Wallingford, UK.

Tarditi, S. and Zanias, G. (2001). 'Common Agricultural Policy'. In R. Hal, A. Smith, and L. Tsoukalis, eds. *Competitiveness and Cohesion in EU Policies*. Oxford: Oxford University Press, 179-16.

Todaro, M. P. (1969). A Model of Labour Migration and Urban Unemployment in Less Developed Countries. *American Economic Review,* 59, 138-48.

Woldehanna, T., Lansink, A.O. and Peerlings, J. (2000). Off-farm Work Decision on Dutch Cash Crop Farms and the 1992 and Agenda 2000 CAP reforms. *Agricultural Economics*, 22, 163-171.

Table 1. Sample of country regions considered

Country	NUTS	Number of regions
Belgium	(2)	10
Denmark	(2)	5
Greece	(2)	11
France	(2)	22
Germany	(1)	14
Ireland	(2)	2
Italy	(2)	21
Luxembourg	(2)	1
The Netherlands	(2)	12
Austria	(2)	9
Portugal	(2)	5
Finland	(2)	4
Sweden	(2)	8
Spain	(2)	17
United Kingdom	(1)	12
Total		*153*

Notes: We miss information on the four French overseas-departments, the two Portuguese regions Madeira and Azores, the two Greek regions Voreio Aigaio and Notio Aigaio, the Aland region in Finland, and the Bruxelles-Capitale region in Belgium due to lack of data.

Table 2. Descriptive statistics

Variable		Mean	Std.Dev.	Min	Max
Out-farm migration	Growth rate	0.026	0.075	-0.939	0.375
Relative Income	Ratio	2.114	1.461	0.475	30.92
Relative Labour	Ratio	34.36	53.03	1.25	605.45
Unemployment rate	%	8.52	5.06	1.59	36.11
Population density	Persons /Km2	263.31	513.75	3.01	4796.32
Family Farm Labor Force	Annual work unit	1.324	0.256	0.430	2.160
Total payments/VA	Share	0.374	0.316	0.000	3.097
Pillar I payments/VA	Share	0.276	0.217	0.000	1.982
Coupled payments/VA	Share	0.226	0.215	0.000	1.982
Decoupled payments/VA	Share	0.050	0.123	0.000	0.750
Pillar II payments/VA	Share	0.098	0.144	0.000	1.172

Source: see text

Table 3. Out-farm migration and the CAP: Difference-in-differences results

Dependent variable: Out-farm migration					
	Difference-in-differences				
Variables	(1)	(2)	(3)	(4)	(5)
Total payments	-0.0083***				
	(0.0026)				
Pillar I payments		-0.0133***			
		(0.0048)			
Coupled payments			-0.0125***		
			(0.0044)		
Decoupled payments			-0.0597***		
			(0.0141)		
Pillar II payments				-0.0186***	
				(0.0053)	
Agrienvironment					-0.0188**
					(0.0074)
Less favoured areas					-0.1039***
					(0.0388)
Investiment aids					0.0321
					(0.0302)
Other pillar II payments					-0.0830
					(0.2843)
Relative income	0.0071***	0.0072***	0.0076***	0.0071***	0.0069**
	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0027)
Relative labour (diff)	0.0044**	0.0044**	0.0044**	0.0044**	0.0044**
	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)
Unemplyment (diff)	0.1122	0.1112	0.0955	0.1134	0.1143
	(0.1293)	(0.1289)	(0.1272)	(0.1300)	(0.1316)
Population density	-0.1513**	-0.1523**	-0.1716***	-0.1489**	-0.1581**
	(0.0692)	(0.0685)	(0.0654)	(0.0703)	(0.0716)
Family work	-0.0097	-0.0097	-0.0112	-0.0095	-0.0123
	(0.0087)	(0.0086)	(0.0086)	(0.0087)	(0.0084)
Decoupling dummy	0.0028	-0.0137*	-0.0039	-0.0013	0.0018
	(0.0061)	(0.0074)	(0.0067)	(0.0099)	(0.0100)
Constant	0.0686***	0.0695***	0.0755***	0.0537**	0.0594**
	(0.0224)	(0.0223)	(0.0213)	(0.0234)	(0.0231)
No. of obs.	2600	2600	2600	2600	2600
R-Sq	0.30	0.30	0.30	0.30	0.30

Notes: Region, and year fixed effects included in each regression. Robust standard errors clustered by region in parentheses. *, ** and *** indicate statistically significance at 10%, 5% and 1% level, respectively.

Table 4. Out-farm migration and the CAP: Differences GMM results

Dependent variable: Out-farm migration					
	Differences GMM				
Variables	(1)	(2)	(3)	(4)	(5)
Total payments	-0.0088***				
	(0.0024)				
Pillar I payments		-0.0123***			
		(0.0036)			
Coupled payments			-0.0118***		
			(0.0034)		
Decoupled payments			-0.0491*		
			(0.0250)		
Pillar II payments				-0.0202***	
				(0.0059)	
Agrienvironment					-0.0214***
					(0.0074)
Less favoured areas					-0.1060**
					(0.0510)
Investiment aids					0.0464
					(0.0349)
Other pillar II payments					-0.1118
					(0.1847)
Relative income	0.0066*	0.0066*	0.0072**	0.0065*	0.0063*
	(0.0034)	(0.0034)	(0.0033)	(0.0035)	(0.0034)
Relative labour	-0.0016***	-0.0016***	-0.0015***	-0.0016***	-0.0016***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Unemployment	-0.6084**	-0.5990**	-0.5453*	-0.6226**	-0.5460**
	(0.2693)	(0.2670)	(0.2836)	(0.2721)	(0.2584)
Population density	0.0150	0.0129	-0.0177	0.0220	-0.0057
	(0.1926)	(0.1928)	(0.2000)	(0.1921)	(0.2015)
Family work	-0.0089	-0.0087	-0.0082	-0.0092	-0.0108
	(0.0144)	(0.0144)	(0.0144)	(0.0144)	(0.0143)
Decoupling dummy	-0.0158**	-0.0158**	-0.0046	-0.0160**	-0.0141*
	(0.0071)	(0.0071)	(0.0118)	(0.0071)	(0.0073)
Lagged migration	-0.0799*	-0.0801*	-0.0806*	-0.0796*	-0.0825*
	(0.0468)	(0.0469)	(0.0464)	(0.0467)	(0.0477)
No. of obs.	2411	2411	2411	2411	2411
No. Groups	153	153	153	153	153
No. Instruments	147	147	148	147	150
AR2 test (p-value)	0.748	0.748	0.761	0.747	0.801
Hansen test (p-value)	0.153	0.151	0.152	0.157	0.134

Notes: year fixed effects included in each regression. Robust standard errors in parentheses. *, ** and *** indicate statistically significance at 10%, 5% and 1% level, respectively. All variables are used as instruments in model. The difference-GMM estimator is implemented in STATA using the xtabond2 routine with option laglimits (10).

Table 5. Out-farm migration elasticity to CAP payments

	D-in-D	GMM - Differences	
		Long-run	Short-run
Total payments	-0.121	-0.159	-0.146
Pillar I payments	-0.143	-0.165	-0.152
Coupled payments	-0.110	-0.128	-0.118
Decoupled payments	-0.118	-0.125	-0.115
Pillar II payments	-0.071	-0.094	-0.087
Agrienvironment	-0.030	-0.043	-0.039
Less favoured areas	-0.078	-0.102	-0.094

Notes: The table reports sample mean elasticity of CAP policy variables based on difference-in-differences and Difference GMM regression results of Table 3 and 4, respectively.