

Full Research Article

# The income effect of CAP subsidies: implications of distributional leakages for transfer efficiency in Italy

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**Abstract.** Enhancing farm income level is one of the main purpose of the Common Agricultural Policy (CAP). The ability to reach such a goal can be measured in terms of transfer efficiency, that is affected by the presence of distributive leakages through the agro-food system. The present work aims to shed light on the income distributional effects of the main forms of CAP subsidies in Italy over the period 2008–2014: single payment scheme, coupled payment and second pillar aids. To this aim, an Arellano–Bond linear dynamic panel-data estimation (based on a database provided by the Italian FADN) is performed. Results show that all the main types of CAP support have a significant income effect, even though some relevant differences occur between decoupled and coupled components of direct payments received by Italian farmers as a consequence of distributional leakages.

**Keywords.** CAP subsidies, transfer efficiency, income effect, Arellano-Bond, Italy.

**JEL Code.** Q18

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## 1. Introduction

In the last decades, the Common Agricultural Policy (CAP) has moved from price support policies to direct payments, causing a dramatic increase of the transparency of transfer. As a consequence, public aids for farmers has been scrutinized by the general public and taxpayers who are interested to know who receives such payments (Agrosynergie, 2011). Moreover, the distribution of subsidies and incomes among subjects and economic sectors became a relevant topic, because some of those may not be the primary intended beneficiaries of the policy.

The incidence of agricultural policy has been investigated by measuring the transfer efficiency, that provides a means for comparing the benefits to producers with the combined costs to consumers and taxpayers and to society as a whole. This term is usually defined as the ratio of income gain of the targeted beneficiaries and the sum of the associ-

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ated governments expenditure and consumer costs (Dewbre *et al.*, 2001). All in all, this concept allow assessing the distribution of the costs and benefits of the policy among different interest groups, defined in terms of their roles as consumers, taxpayers, producers or suppliers of factors of production (Alston and James, 2002). Despite a significant literature has paid attention mainly to some specific mechanism that affect transfer efficiency (such as the capitalization effect of the Single Payment Scheme), Scholars have also focused on the transfer efficiency of agricultural support as a whole, in order to evaluate and somehow measure the whole effectiveness of agricultural policies in delivering additional income to farm households. In this regard, empirical evidences tend to support the theoretical findings that not only agricultural producers, but also other market participants along the vertical chain, may benefit from agricultural subsidies. OECD (1996) reported that a broad quantification of transfer efficiency suggests that as little as one-fifth of the benefits of market price support resulted in additional income for farm households. In more detail, it has been demonstrated that those support measures causing the greatest distortion to production and trade are also the least efficient in providing income benefits to farmers (Dewbre *et al.*, 2001). It clearly follows that the type of support matters when measuring its impact on farm income.

The present work aims to shed lights on the distributional effects of the main forms of CAP subsidies in Italy over the period 2008-2014, where both coupled and decoupled payments have been coexisting along with second pillar aids (that is, Rural Development Programs – RDPs). To this purpose a dynamic panel data estimation is implemented to quantify the impact of these different policy tools on farm income and to indirectly evaluate the transfer efficiency of these aids. The paper is organized as follows: section two reports the literature on transfer efficiency of CAP aids with particular emphasis on the comparison among the different types of public aids. Section three describes the evolution of the CAP instruments in Italy. Section four illustrates data and the empirical methods used in the study. Section five shows empirical findings and discusses the results in the lights of the existing literature. Lastly, conclusion and final remarks are reported.

## 2. Theoretical framework

### 2.1 The transfer efficiency

Where income support is an objective, it is important that the policy pursues it in an efficient way, since the ability of the considered policy to enhance the income level of agricultural households can be measured in terms of transfer efficiency. In this regard, three main source of inefficiency have been reported by Agrosynergie (2011): targeting efficiency, economic costs and distributive leakages. As for the first aspect, Corden (1957), Bhagwati (1971) and more recently Guyomard *et al.* (2004) show that the standard policy recommendation is to follow the principle of targeting policies to their specific objectives. With concerns to the second element, subsidies are costly to introduce, administer and enforce; these costs and the effects of producer responses to the incentive to cheat also change the deadweight losses from each of the policies, their distributional consequences and their efficiency as means of transferring income to producers (Alston and James, 2002). The latter issue refers to the case in which a part of the economic support “leak” to non-farm

owners of resources, as it is benefitted from subjects who may not be intended beneficiaries of the policy by means of both increased farm production costs and decreased farm income. According to the OECD (1996) “*no support policy linked to agricultural activity succeeds in delivering more than half the monetary transfer from consumers and taxpayers as additional income to farm households*”. Despite the leakages could also be viewed as a sort of positive spillover effect that impact on incomes of other stakeholders of the agri-food system (input suppliers, consultancy services, buyers and so on), the intriguing question is: where does the rest of the money for farmers provided by the public authorities go?

The overall subsidy effect on farm income depends on the magnitudes of multiple factors. First, subsidies may increase input prices (for example, fertilizers, land and capital), thus channelling policy benefit to input suppliers. Since subsidy-induced changes in input use are likely to result in changes in some input prices, therefore named recipient of the subsidy payment is unlikely to capture all of the benefits. Second, subsidies may lead to lower output prices, thus generating policy gains for consumers, Third, subsidies may interact with other markets (as in credit constraint) or may alter farm behaviour (substitute private farm activities), which may enhance or reduce farm profits depending on the type of induced effect (Ciaian *et al.*, 2015; Ciaian and Swinnen, 2009).

To sum up, whether agricultural support benefits farmers closely depends on whether farmers own the resources they use in production (Latruffe and Le Mouël, 2009). When farmers do not own such inputs, payments may not belong to the group of the intended main beneficiaries of the policy. Indeed, empirical evidence exists on the fact that part of the support provided by agricultural policies (including direct payments) contributes to increasing the costs of resources, the income of input suppliers and the income of non farming landowners. However, the level of transfer efficiency and the destination of the money transfer differ according to the policy instrument (Agrosynergie, 2011).

## 2.2 Types of support and transfer efficiency

The literature review reveals that scholars have investigated how income distributional effects differ based on subsidy types. Empirical evidences indicated that compared to area payments, market price support is indeed a relatively inefficient and trade distorting way of supporting farm incomes. Direct payments based on output or on variable input use, however, are also highly inefficient and trade distorting when compared to area payments. This latter, requiring planting of specific crops, are however less efficient and more trade distorting than payments made irrespective of the use to which the land is put (Dewbre *et al.*, 2001). Moreover, farmers report that the largest share of direct payment receipts tend to be used to cover agricultural production crops (Goodwin and Mishra, 2005). As a consequence, an increased demand for inputs drives the increase in factor expenditure, with significant effects on the costs of input (land, fertilizers, pesticides and so on) (Kirwan, 2009).

### 2.2.1 Leakages related to coupled payments

Many scholars have analysed how income distributional effects differ between coupled and decoupled payments. It is well known that some income support policies are explicitly linked with production decisions in the sense that these latter can alter the magnitude of

income support: this linkage is generally called coupling and breaking the linkage is called decoupling. The term “coupled” itself links payments to a specific stimulating production activity and these payments are available to farms in all Member States and include crop area direct payments and animal direct payments. In general, studies focus on the effects of coupled subsidies in narrowly defined agricultural sectors and results showed that a significant part of coupled payments could be leaked away to other agents through changes in market prices and this effect diminishes farms’ benefits from subsidies. The leakage is positively correlated with coupling because it implies a stronger link of subsidies to farm activities and thus stronger impact on the aggregate price level (Rizov *et al.*, 2013). More in general, since coupled payments clearly have production impacts and due to the fact that the greater the production impact of direct payments the less they push up rental values, it follows that such an increased production results in lower commodity prices and higher input prices as well as it also dilutes the impact that direct payments have on land rent (Kirwan, 2009).

### 2.2.2 Decoupled payments and the capitalization effect

As a consequence, because the production impacts of explicitly coupled supports sometimes have been quite substantial and costly to the government, many policies have been modified to reduce or break the coupling (Hennessy, 1998). Therefore, the last reforms of the CAP have led to the decoupling of direct payments from production.

Decoupled payments were introduced in order to curb over-production and to reduce the trade-distorting and inefficiency effects of the CAP (Howley *et al.*, 2012). Literature suggests that, depending on both farm size and the duration of the tenant-landlord agreement, the decoupled direct payments linked to land positively influence land rents, because only those who own or have rented (eligible) land can claim the payments (Kilian and Salhofer, 2008; Kirwan and Roberts, 2015). This result is due to the fact that the SPS is still “coupled” to agricultural land and has a high potential for capitalization into land values. With some exceptions (Guastella *et al.*, 2013), scholars showed that decoupled payments exert a larger impact on rents than coupled payments. Such a capitalization effects vary from 0.20 to 0.90 euro (or dollar) for each euro transferred to the farmers (Ciaian and Kancs, 2012; Kirwan, 2009; Patton *et al.*, 2008; O’Neill and Hanrahan, 2016; Breustedt and Habermann, 2011; Kilian *et al.*, 2012). Under certain circumstances the decoupled payments are even fully reflected in rental values (Hendricks *et al.*, 2012). More in general, whether agricultural support benefits farmers closely depends on whether farmers own the resources they use in production (Latruffe and Le Mouël, 2009). It follows that, the greater the share that goes to land and landowners, the less effective direct payments ultimately become as a means of supporting farmers’ incomes (Patton *et al.*, 2008). As a consequence, what appears clearly is that part of the payments is capitalized in land prices, implying that the governments could have partially missed their target of providing income support to farmers (Latruffe and Le Mouël, 2009).

### 2.2.3 Second Pillar aids and distributional impacts

Lastly, potential leakages effects could also affect RDP aids, that include different policy measures, ranging from area payments to investment supports. As for the first

category, both less favoured area (LFA) payments and agri-environmental payments are compensatory type of aids, granted for a range of farm activities that should cover additional costs and farm income foregone resulting from adoption of environmental management practises (Ciaian *et al.*, 2015). The transfer efficiency of such a type of area payments may again be hindered by the above-mentioned capitalization of the aids into the land value. The second category covers only a share of the total cost of a programme of investment activity either for farm practises (capital items) or for a farmer (training courses and other qualifications). Since these public aids are known by suppliers, they can be partially absorbed into the prices for input and services, so that the transfer efficiency of the payment decreases.

### **3. Policy framework: the application of the CAP in Italy**

CAP reforms have seen a progressive move away from direct market interventions and production specific subsidies. To this purpose, since 1992 the CAP of the EU has been reformed several times. First Pillar (direct payments and Common Market Organization - CMO) is the most important in financial terms and it currently consumes more than 60% of the overall CAP resources (Henke and Coronas, 2011; Ciliberti and Frascarelli, 2015).

#### *3.1 Decoupled payments*

The 2003 Fischler CAP reform significantly reduced and partially replaced the previous coupled payments system with the decoupled payments (SPS). Under this scheme, each farm was allocated an amount of entitlements; they can receive decoupled payments if they have both entitlements and an equal amount of eligible land. However, the SPS is not linked to a specific land area, since the entitlements can be activated by any eligible farmland in the region. Moreover, farms can expand or decrease their stock of entitlements by buying or selling entitlements on the market from other farms. As concerns Italy, it must be noted that the historical model of the SPS was implemented from 2005 to 2014. Under this model the payment per hectares varied strongly across farms, depending on the coupled payments farmers received in historical reference period (2001-2003) (Erjavec *et al.*, 2011).

#### *3.2 Coupled payments*

CDPs include crop area direct payments and animal direct payments. In general, they are land-based subsidies linked to the cultivation of certain crops, implying that the level of the crop CDP does not depend on production level, but on the area cultivated with eligible crops. The coupled animal direct payments are either output (animal) type of payments (such as beef premiums, slaughter premiums) or subsidies linked to non-land input.

After the introduction of decoupling in 2005 MSs were allowed to grant optional coupled payments in specific cases. Additional payments granted under Article 69 of Reg.

(EU) 1782/2003 were considered as coupled<sup>1</sup>, with the provision that they were not granted to all producers of a sector, but were based on certain eligibility criteria.

This optionality was maintained after the CAP Health Check in 2009 with the introduction of Article 68<sup>2</sup> of Council Regulation (EC) 73/2009. However, it broadened the range of such Specific Support, with the possibility of granting coupled payments depending on the objectives assigned of the last supply control measures (milk quotas, sugar quotas and vineyard planting rights).

### 3.3 The second pillar

The rural development policy represents the other core element of the CAP that is implemented in a more targeted and programmed approach compared to other measures (Uthes *et al.*, 2017). The paper focuses only on specific measures that absorb a high share of the budget for regional RDP: Less favoured area (LFA) payments, agri-environmental payments and investments support. The LFA scheme is a longstanding measure that provides a broad-scale mechanism for maintaining the countryside in marginal areas. Agri-environment measures provide payments to farmers who subscribe, on a voluntary basis, to environmental commitments related to the preservation of the environment and maintaining the countryside. Lastly, investments aids cover only a share of the total cost of a one-off or short-term programme of investment and/or training activity aiming at improving the competitiveness and sustainability of the farming sector.

## 4. Methodology

### 4.1 The econometric model

Based on theoretical studies, the methodology used assumes a profit-maximizing farm and analyses the effect of subsidies on farm profits. According to the literature assuming a profit-maximizing farm (Floyd, 1965; Alston and James, 2002; de Gorter and Meilke, 1989; Gardner, 1983; Guyomard *et al.*, 2004; Salhofer, 1996; Ciaian and Swinnen, 2006, 2009; Ciaian *et al.*, 2015), the optimal farm profit ( $\pi$ ) depends on input and output prices, subsidies and farm characteristics.

In details, consider an agricultural economy with  $n$  farms. The output of each farm is a function of the amount of land ( $A$ ) and non-land inputs ( $K$ ), which captures also other capital inputs used by the farm. The production function is represented by  $f(A, K)$  with  $f_i > 0$ ,  $f_{ii} < 0$ ,  $f_{ij} > 0$ , for  $i, j = A$  and  $K$ . Furthermore, define  $s$  as the subsidy (area payment) per unit of land, and assume that all land in the analysis qualifies for the subsidies, the representative farm objective function is (Ciaian and Swinnen, 2009):

$$\pi = pf(A, K) + sA - rA - wK(1+i) \quad (1)$$

<sup>1</sup> In Italy, this type of payment was activated for several sectors: cereals, oilseeds and protein crops, tobacco, sheep and goat and so on.

<sup>2</sup> Under Article 68 sectors supported under the quality measure for the period 2010-2014 are beef meat, sheep and goat meat, olive oil, milk, tobacco, sugar and floriculture.

where  $p$  is the price of the final product,  $s$  are subsidies for unit of land,  $r$  is the price of land,  $w$  is the unit price of other capital inputs, and  $i$  is the interest rate.

More precisely, profit is affected by both the indirect (that is, through subsidy impact on input and output price) and the direct effects of subsidies on profits, as follows (Ciaian *et al.*, 2015):

$$\pi = \pi[p(CDP, RDP, SPS), r(CDP, RDP, SPS), w(CDP, RDP, SPS), CDP, RDP, SPS, X] + \varepsilon \tag{2}$$

where, as concern subsidies, CDP are crop coupled subsidies, RDP are rural development payments, SPS are decoupled payments. Moreover,  $X$  is a vector of observable covariates and  $\varepsilon$  is the residual.

It follows that the profit equation (2) accounts for both the direct and indirect effect of subsidies on farm profits. Totally differentiating equation (2) yields the following relationship between profits and subsidies:

$$\begin{aligned} d\pi = & \left[ \frac{d\pi}{dp} \frac{dp}{dCDP} + \frac{d\pi}{dr} \frac{dr}{dCDP} + \frac{d\pi}{dw} \frac{dw}{dCDP} + \frac{d\pi}{dCDP} \right] dCDP + \\ & \left[ \frac{d\pi}{dp} \frac{dp}{dRDP} + \frac{d\pi}{dr} \frac{dr}{dRDP} + \frac{d\pi}{dw} \frac{dw}{dRDP} + \frac{d\pi}{dRDP} \right] dRDP + \\ & \left[ \frac{d\pi}{dp} \frac{dp}{dSPS} + \frac{d\pi}{dr} \frac{dr}{dSPS} + \frac{d\pi}{dw} \frac{dw}{dSPS} + \frac{d\pi}{dSPS} \right] dSPS + \frac{d\pi}{dX} dX + \varepsilon \end{aligned} \tag{3}$$

where  $\frac{d\pi}{dp}$ ,  $\frac{dp}{ds}$ ,  $\frac{d\pi}{dr}$ ,  $\frac{dr}{ds}$  and  $\frac{d\pi}{dw}$ ,  $\frac{dw}{ds}$  are parameters representing the indirect impact of subsidies on profits (that is, through subsidy impact on input and output prices) and  $\frac{d\pi}{ds}$  is the direct effect of subsidies on profits for  $s = CDP, RDP, SPS$ .

Equation (3) can be rewritten as:

$$d\pi = \delta_0 + \delta_{CDP} dCDP + \delta_{RDP} dRDP + \delta_{SPS} dSPS + \delta_X dX + \varepsilon \tag{4}$$

where

$$\begin{aligned} \delta_x = & \frac{d\pi}{dX}, \delta_{CDP} = \frac{d\pi}{dp} \frac{dp}{dCDP} + \frac{d\pi}{dr} \frac{dr}{dCDP} + \frac{d\pi}{dw} \frac{dw}{dCDP} + \frac{d\pi}{dCDP}, \delta_{RDP} = \\ & \frac{d\pi}{dp} \frac{dp}{dRDP} + \frac{d\pi}{dr} \frac{dr}{dRDP} + \frac{d\pi}{dw} \frac{dw}{dRDP} + \frac{d\pi}{dRDP}, \delta_{SPS} = \\ & \frac{d\pi}{dp} \frac{dp}{dSPS} + \frac{d\pi}{dr} \frac{dr}{dSPS} + \frac{d\pi}{dw} \frac{dw}{dSPS} + \frac{d\pi}{dSPS} \end{aligned}$$

Parameters  $\delta_s$  (for  $s = CDP, RDP, SPS$ ) measure the net impact of subsidies on farm profits by accounting for the above-mentioned both direct and indirect subsidy effects. In

other words, they indicate the income effects of subsidies in terms of policy rents, which farmers receive for each additional euro of CAP subsidies.

Even though the model contains the main variables determining the incidence of agricultural subsidies, there are also unobservable time-invariant farm characteristics which both affect dependent variable and are correlated with explanatory variables. In addition, there are also time-varying region fixed effects that cannot be ignored. Therefore, in order to reduce possible sources of bias, farm fixed effects are included (Ciaian and Kancs, 2012). Moreover, according to Kirwan (2009), in order to absorb farm-specific time-invariant unobserved factors, the first difference of the series are applied, since the resulting farm income model in the first difference eliminates the unobserved heterogeneity component that remains fixed over time. As a result, the final econometric model is specified as follows:

$$\Delta\pi_{jt} = \delta_0 + \delta_{CDP}\Delta CDP_{jt} + \delta_{RDP}\Delta RDP_{jt} + \delta_{SPS}\Delta SPS_{jt} + \delta_X\Delta X_{jt} + \delta_r R_r + \delta_{ff_j} + \varepsilon_{jt} \quad (4)$$

where  $\pi$  is the profit of the farm  $j$  at the time  $t$ .

However, an estimation issue is due to the fact that subsidies are not assigned to farmers randomly, but rather they are affected by regional productivities and farms' crop choices (Moro and Sckokai, 2013). This fact implies that in the econometric model these variables (CDP, SPS, RDP, OS) are endogenous since they reflect the characteristics of countries'/regions' land and farmer's behaviour.

First, in order to reduce the individual heterogeneity bias, farm fixed effects and regional control variables are included in the estimable equations, respectively  $\delta_{ff_j}$  and  $\delta_r R_r$ . In more details, the first differences of series are adopted in order to absorb farm-specific time-invariant unobserved factors, since they eliminate the unobserved heterogeneity component that remains fixed over time. Lastly, in order to address the issue of endogeneity, the Arellano and Bond robust two-step generalized method of moment (GMM) estimator is applied and a set of valid and reliable instruments is adopted (see table 1). The GMM estimator is applied since it is particularly suitable for datasets with a large number of cross sections. Lastly, the Windmeijer (2005) bias-corrected robust variances is used in order to correct for the intrinsic downward bias of the robust two step GMM standard errors.

#### 4.2 Data and variables

The source of data used in the empirical analysis is the Italian FADN (Farm Accountancy Data Network) provided by the Council for Agricultural Research and Economics (CREA). The FADN is the only source of micro-economic data that is harmonized and is representative of the commercial agricultural holdings in the whole EU (Moro and Sckokai, 2013). The survey does not, however, cover all the agricultural holdings in the EU, but only those which are of a size allowing them to rank as commercial holdings.

Based on previous study (Ciaian and Kancs, 2012; Michalek *et al.*, 2014; Ciaian *et al.* 2015) in the present study a balanced panel dataset with 24'668 observations of  $n=3'524$  Italian farms over the period 2008-2014 ( $t=7$ ) is adopted, meaning that farms in the sample are traced over the same period of time. Moreover, the sample is stratified on three

key variables, i.e. location (21 NUTS regions and 3 altimetric areas), economic size (6 size classes) and farm type (19 typologies).

Variables used in the econometric model are organized in order to effectively identify the relationship between net farm income<sup>3</sup> and subsidies (table 1). Descriptive statistics are provided in table A of the Appendix.

More in details, the dependent variable is calculated as the change in net farm income. Based on the document “Farm accounting data network: an A to Z methodology” (European Commission, 2010) the net farm income is obtained by subtracting taxes, variable expenses (intermediate, land, labour) and fixed costs (depreciation and interest payments) from the total farm revenues (output and subsidies). As concerns subsidies, they are SPS, CDPs (crop area payments, animal payments), the RDP (investment support, environmental payments, LFA and other rural development payments) and OS (that accounts for other types of subsidies, such as those from the CMO). The above-mentioned variables are expressed per hectare. The advantage of using per hectare values instead of totals per farm is the reduction of the potential problem of heteroskedasticity. The farm size varies strongly in regions and sectors covered by this study, implying that the value of farm income, as with the other variables (output, subsidies and so on), also varies significantly in the cross-sectional dimension.

In order to account for the dynamic adjustment of farm income, lagged dependent (1 lag) is created in order to incorporate feedback over time. Moreover, since variables related to subsidies (CDP, SPS, RDP and OS) are endogenous, lags are used as instruments along the exogenous and lagged dependent variables. More in details, the choice of lags as instruments was selected by checking the validity of different sets of instruments. Table 1 summarizes both lags and type of variables (exogenous, endogenous and instrumental).

The covariates matrix (X) includes variables which contribute to explain the variation in profits among farms, respectively referred to two main categories: inputs and productivity and management practises.

Independent variables linked to the first set of covariates include rented land ratio (expressed as the ratio of rented land to UAA, *Rented\_land*), sharecropped land (expressed as the ratio of sharecropped land to UAA, *Share\_land*), own labour ratio (that is the ratio of unpaid input to total labour, *Own\_labour*), and liabilities-to-assets ratio (that is the ratio of total liabilities to total farm assets, *Liabilities\_assets*).

Given that productivity is an important determinant of farm profitability, if not controlling for its variation among farms, it may be confounded with the estimated subsidy effect on profits. Therefore, productivity differences among farms are controlled including in the econometric model variables. They are: output per hectare (*Output*), farm size (expressed in ESU), irrigated land ratio (ratio of irrigated land to UAA), the building machinery value per hectare (*Machinery*) and the ratio of total livestock output to total farm output (*Output\_livestock*), the total livestock units (LU) and the stock of agriculture products (*product\_stock*).

Likewise, management practises affect the organization of farm activities and thus also have a direct impact on farm profitability. Covariates capturing those practises are the

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<sup>3</sup> Even though there could be income effects from the subsidies beyond the farm operating income, the household non-farm income is not accounted since it is well-known that one of the main CAP goals is to enhance farm incomes.

**Table 1.** List of variables.

Category	Variable name	Lags	Type	Description	Unit of measure
Dependent variable( $\pi$ )	NFI	1	:	Net farm income	€/ha ( $\Delta\%$ )
Subsidies (s)	CDP	0 and 1	endogenous	Coupled payments	€/ha
	SPS			Decoupled payments	€/ha
	RDP			Rural development payments	€/ha
	OS			Other subsidies	€/ha
Covariates (X) - inputs -	Rented_land	0	exogenous	Ratio of rented area to Utilized agricultural area (UAA)	%
	Share_land			Ratio of sharecropped land to UAA	%
	Own_labour			Ratio of unpaid input to total labour	%
	Liabilities_assets			Ratio of total liabilities to total farm assets	%
Covariates (X) - productivity -	Output	0	endogenous	Hectare value of total output of crops and crop products, livestock and livestock products and of other products	€/ha
	Size	0	instrumental	Economic size of holding expressed in European size units (ESU)	€
	Irrigated_land			Ratio of irrigated land to UAA	%
	Machinery			Value of buildings and machinery	€/ha
	Output_livestock			Ratio of total livestock output to total farm output	%
	LU			Total livestock units	N. of head
	Product_stock			Stock of agricultural products	€/ha
Covariates (X) - management practises -	Own_consumption		exogenous	Ratio of farmhouse consumption and farm use to total output	%
	Wood_land			Ratio of woodland area to UAA	%

own consumption ratio, that indicate the ratio of farmhouse consumption and farm use to total output, as well as the ratio of woodland area to UAA.

## 5. Results and discussion

Henceforth outcomes of the Arellano-Bond test for the Italian FADN sample (based on period 2008-2014) are shown. First of all, it must be noted that the specification test allows not rejecting the null hypothesis of no serial autocorrelation in the first-differenced errors at order 1. It entails that the model has not misspecification problem. Concerning the Sargan test of over identifying restrictions, it shows that the instrumental variables are uncorrelated to some set of residuals and therefore they are acceptable instruments. Moreover, the Windmeijer bias-corrected robust standard errors allow to both account for

heteroscedasticity and correct for autocorrelation as well.

In order to facilitate the presentation and the relative discussion of results, table 2 reports different categories of variables used in the model (i.e., lagged dependent, subsidies and covariates). What emerges from the estimations is that the farm income at the time  $t-1$  somehow negatively affects (-0.005) the farm income at the time  $t$ . Even though this result may seem counterintuitive, it indeed recalls the well-known “cobweb theorem” (Kaldor, 1934; Ezekiel, 1938). This latter explains how price instability in a supply-demand framework – caused by low price elasticity of supply and demand – along with the assumption of a lagged response by production to price changes, can give rise to irregular fluctuations in prices and quantities in agricultural markets. Such a peculiar characteristic of the agricultural sector obviously causes unexpected and reverse relationships between prices, quantities and, as a consequence, incomes at various stages in time.

The contribution of the model however concerns the effect of CAP subsidies on farm income over the period under investigation. All the main variables related to public aids (that is, CDP, SPS, RDP, OS) are significant. SPS represents the main source of public support for farmers and results highlight that it is highly able to sustain incomes. In this regard, it should be noted that the total income effect (e.g. including both contemporaneous and lagged effect) of the SPS is 0.978, implying that a great part of such aid is transferred to farmers and only a small share goes to the other actors of the supply chain (landowner, input suppliers and output buyers). In this regard, since the implementation of the SPS scheme started in 2005, a flourishing literature has pointed out the potential distortive effect due to the fact that non-farming landowners can extract a rent from such form of payment that is indeed “coupled” to the land (Ciaian and Kancs, 2012; Ciaian and Swinnen, 2006; Kilian and Salhofer, 2008; Kirwan and Roberts, 2015; Klaiber *et al.*, 2017; Patton *et al.*, 2008; Viaggi *et al.*, 2013). According to the literature in this field, the capitalization effect of SPS into land rents varies from 0.2 to 0.8 (Breustedt and Habermann, 2011; Kilian *et al.*, 2012; O’Neill and Hanrahan, 2016; Patton *et al.*, 2008). These results imply that depending on specific characteristics of each MSs on average about half of the direct aids are capitalized into land rents. In more details, as for New EU Member States (EU-12), the rental price of farmland increases between 0.18 and 0.20 EUR for each unit of SPS payment<sup>4</sup> (Ciaian and Kancs, 2012). Moreover, other studies confirm that also in the US a significant share of the direct aids are reflected in rental rates (varying from 20% to 100%, depending on the form of support). All in all, the model reveals a high transfer efficiency for SPS in the observed period, meaning that the capitalization of the SPS into the land rents in Italy was scarce, according to Guastella *et al.* (2013). Furthermore, it must be noted that, since their introduction decoupled payments have not completely led farmers to be more market oriented (Burfisher and Hopkins, 2003; O’Neill and Hanrahan, 2016), and such an effect may have reduced the transfer efficiency, as confirmed by

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<sup>4</sup> It is a transitional, simplified income support scheme which was offered to the Member States who joined the EU in 2004 and 2007 (EU-12) as an option at the date of accession in order to facilitate the implementation of direct payments. This scheme replaces (with some exceptions) all direct payments with a single area payment. The level of the payment is obtained by dividing the country’s annual financial envelope with its respective utilized agricultural area. It is simpler than the SPS because there is no need to establish and administer payment entitlements. However it does not offer to farmers the flexibility of entitlements based on individual needs, such as sales or lease.

**Table 2.** Arellano-Bond (first difference) dynamic GMM estimator: results (estimates based on period 2008-2014).

Variable	Coefficient (Std. Err.)	P>z	
NFI (-1)	-0.005 (0.000)	0.000	***
CDP	-1.242 (0.376)	0.001	**
CDP (-1)	0.540 (0.195)	0.006	**
SPS	0.117 (0.069)	0.089	*
SPS (-1)	0.861 (0.320)	0.007	**
RDP	0.067 (0.010)	0.000	***
RDP (-1)	0.215 (0.010)	0.000	***
OS	-0.197 (0.037)	0.000	***
OS (-1)	-0.061 (0.022)	0.007	**
Rented_land	3.325 (3.633)	0.360	
Share_land	6.104 (3.379)	0.071	*
Own_labour	3.106 (2.709)	0.252	
Liabilities_assets	-0.103 (0.091)	0.258	
Output	0.055 (0.001)	0.000	***
Own_consumption	-11.675 (5.424)	0.031	**
Wood_land	-1.870 (2.997)	0.533	
Observations	17620		
Number of farms observed	3524		
N. of instruments	77		
Wald chi2	5257.30	0.000	***
Arellano-Bond for zero autocorrelation in first-differenced errors (H0: no autocorrelation)			
AR(1) (Prob>z)	-1.345	0.178	
AR(2) (Prob>z)	-0.991	0.321	
Sargan test of over identifying restrictions H <sub>0</sub> : overidentifying restrictions are valid			
SR (Prob>chi <sup>2</sup> )	57.295	0.610	

\*p<0.10; \*\*p<0.05; \*\*\*p<0.001

empirical evidences of decoupled payments used so as to subsidise loss-marketing activities (Breen *et al.*, 2005; Howley *et al.*, 2012; Kazukauskas *et al.*, 2014).

With regard to RDP measures, estimates point out a significantly positive influence of these aids on farm income. What emerges is that the total effect (lagged plus simultaneous effect) on farm income is 0.282 for each euro of RDP aids, even though these aids do not evidently aim to sustain farm income. Indeed, it is well-known that their main objectives are, on the one hand, to foster various types of investments (in both physic and human capital) and, on the other hand, to cover opportunity costs related to the adoption of low income (but environmental-friendly) activities and techniques (e.g., organic farming and so on) mostly in disadvantaged areas. Moreover, since both agri-environmental and less

favoured area payments are linked to the amount of land owned/rented, a possible explanation of such a result could be that a significant amount of these aids could be capitalized into rental values as well as in the input prices (seeds, fertilizers, machines and so on) as well as in the cost of services (transaction costs, assistance costs and so on).

Very interestingly, the other type of direct payment of the First Pillar – the CDP – shows an immediate negative effect on farm income (-1.242), followed by a lagged but positive impact on profitability (+0.540). Therefore, what emerges is that the total effect of CDP on farm income is still negative (-0.702). Here, many causes may potentially determine such an impact that could explain why this form of payment has been criticized since its introduction in the early '90s. Scholars have indeed always recognized that such an aid is able to affect (and somehow to distort) product decisions, by incentivizing the cultivation of specific crops without taking into account the real needs of the demand, with negative consequence both on farm efficiency and total factor productivity (Hennessy, 1998; Mary 2013; Zhu *et al.*, 2012). Such an impact on production decision may explain the negative impact on farm income in the short run, due to the fact that the CDP induces farmers to produce/feed not profitable crops/livestock. In addition to this opportunistic behaviour that such a payment generates on the supply side, inducing beneficiaries to “farm” the subsidies in spite of the crops, in the meanwhile the presence of an aid linked to specific productions induces input suppliers and buyers of agricultural commodities (i.e., wholesalers, middlemen, processors, manufacturers) to somehow intercept an amount of such a subsidy, by lowering the price of the commodities (Alston and James, 2002; Hendricks *et al.*, 2012; OECD, 1996; Rizov *et al.*, 2013). It follows that the payment is (at least in part) taken away from farmers to the benefit of other actors along the agro-food supply chain (Breen *et al.*, 2005; Ciliberti and Frascarelli, 2015; McDonald *et al.*, 2014; O'Neill and Hanrahan, 2016; Russo *et al.*, 2009). Moreover, Patton *et al.* (2008) showed that different types of coupled payments are capitalized in land rents in Northern Ireland and such an effect absorbs half of the value of the aid. Apart from the above-mentioned explanations, other causes of this outcome could be that CDP has for a long time subsidized low quality production and, more in general, has not represented an incentive for competitiveness at all (Latruffe *et al.*, 2009; Zhu and Oude Lansink, 2010). It, on the contrary, has triggered speculative and opportunistic behaviours that actually hampered a market-oriented approach. Lastly, also the OS shows a total negative effect on farm income (-0.258). Such a result could be attributed to the fact that, likewise CDP, this type of aids are also mainly aimed to subsidize specific products, therefore causing a similar impact on farm incomes.

As concerns covariates, for each set of explanatory variables some estimated coefficients have the expected sign and are significant as well. With regard to the inputs, results confirms that sharecropped land positively contribute to increase the farm income (+6.104), since they represents a cheap alternative to land rent or land tenure. As concerns productivity, the model reveals the expected positive impact of the total output on farm income (+0.055). Accordingly, with regard to management practises, the model confirms that self-consumption (-11.675) – especially in small or very small Italian farms managed by so-called hobby-farmers – obviously causes a relevant and significant decrease of the farm income, due to the fact that the farm output is not sold but is used to satisfy family needs only.

## 6. Conclusions

Even though farmers are the only beneficiaries of various forms of public support established by the CAP, a vast literature has shown that some leakages however occur. Such a phenomenon may be relevant when both input supplier and output buyers (that is, wholesalers, processors, manufacturers), thanks to their market and bargaining power, are able to extract some rents from the public aids. In this regard, the present paper aimed to shed lights on the transfer efficiency of CAP subsidies in Italy. To this purpose, data from the national FADN allowed analysing the distribution of public support among the several players of the Italian agro-food system over the period 2008-2014, so as that a first contribution for this – to the best of the authors' knowledge – still unexplored research field in Italy is provided.

The dynamic panel data estimation reveals that all the main typologies of aids established by the CAP significantly affected the variation of the farm income in Italy. More in details, the national implementation of the SPS, CDP and RDP aids over the investigated period contributed to an increase of the profitability of Italian farms, despite of a significant transfer of public resources from the primary sector to other stages of the agro-food supply chains or even external to the primary sector. Such a phenomenon somehow confirms the presence of opportunistic behaviours of both input suppliers (e.g., landowners and input dealers that increase prices of land/products they rent/sell to farmers in order to indirectly take advantage of the SPS and/or RDP scheme) as well as of buyers that – exploiting their purchasing power – contract lower prices for agricultural commodities. Very interestingly, results show that the impact of CDP negatively affects income variation of Italian farms, even though only in the short run. This type of subsidy, introduced in the early '90s as transitory means of support to replace price support, has been criticized for a long time due to the fact that it clearly influences production decisions and therefore alters market equilibrium. Furthermore, both the existence and the amounts of such a payment, by definition “coupled” to specific crops/livestock, is also well known by several suppliers and buyers that therefore try opportunistically to take advantage from it. As a result, the CDP may simply become a sort of surreptitious transfer of public resources to none other than agro-food industry companies (i.e., suppliers, landowners, processors, manufacturers). Moreover, it may also distort (and reduce) the incentive for quality with immediate negative consequences on output prices and, in the long term, on farms ability to be competitive in both national and international markets.

To sum up, these empirical evidences have important policy implications for the implementation of the CAP in Italy. First of all, results allow confirming that even though farm income substantially benefitted of the implementation of the CAP, the transfer efficiency of public financial resources officially intended for farmers was hindered by leakages that are occurred in Italy over the period 2008-2014. More in details, what emerges is that decoupled income transfers without mandatory production (SPS), as well as incentives for investments and compensatory payments (RDP) are preferable to coupled measures (CDP) for ensuring an annual and continuous support to farmers income.

In conclusion, it is straightforward that a different allocation of CAP resources in Italy may bring more advantages for farmers, decreasing leakages and increasing transfer effi-

ciency. In this regard, an indication for the future is that both the reform paths towards a more targeted and tailored support for farmers and, on the other hand, national implementation of the CAP rules should aim to properly address the causes of such leakages in order to improve the transfer efficiency of public aids, due to the fact that enhancing farm incomes still remains one of the main priority of the CAP.

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## Appendix

**Table A.** Descriptive statistics of variables.

Variable	Obs	Mean	Sd	Min	Max	Unit of measures
NFI	24,668	182.5	20,229.4	-515,950.0	2,637,476.0	( $\Delta$ %) €/ha
CDP	24,668	59.2	341.8	0.0	17,934.4	€/ha
SPS	24,668	297.6	956.8	0.0	105,050.0	€/ha
RDP	24,668	115.3	967.0	0.0	87,273.3	€/ha
OS	24,668	49.5	638.4	0.0	47,050.5	€/ha
Rented_land	24,668	34.2	39.5	0.0	100.0	%
Share_land	24,668	7.8	21.8	0.0	100.0	%
Own_labour	24,668	87.4	22.7	0.0	100.0	%
Liabilities_assets	24,668	4.2	72.2	0.0	6,252.2	%
Output	24,668	13,006.4	48,295.0	-20,524.0	1,724,127.0	€/ha
Size	24,668	117.3	986.5	0.0	98,807.9	€
Irrigated_land	24,668	39.9	43.6	0.0	100.0	%
Machinery	24,668	6,181.9	19,526.8	0.0	512,428.6	€/ha
Output_livestock	24,668	21.8	35.4	0.0	100.0	%
LU	24,668	282.2	4,850.7	0.0	261,093.0	N. of head
Product_stock	24,668	16,443.9	341,083.5	0.0	39,800,000.0	€/ha
Own_consumption	24,668	1.1	3.4	0.0	100.0	%
Wood_land	24,668	3.8	12.9	0.0	100.0	%