Paper prepared for the 123rd EAAE Seminar

PRICE VOLATILITY AND FARM INCOME STABILISATION

Modelling Outcomes and Assessing Market

and Policy Based Responses

Dublin, February 23-24, 2012

The evolution of land values in Italy.
Does the influence of agricultural prices really matter?

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Abstract

Interest towards farmland market has been increasing in recent years. In developing countries there is rising concern about land being purchased by foreign investors, while in the developed world the debate is centred on whether agricultural factors are still the main determinants of land values or not. This work assesses the determinants of land values in Italy using panel data techniques during the time span 1992-2010. In Italy farmland values have historically been influenced more by natural characteristics of the land than agricultural prices. However, lately non-agricultural factors have been increasing their importance. We find that agricultural prices only slightly affect average land values in Italy. Main determinants of land prices are the yield from real estate investment, GDP per capita, house prices, and population density. For arable land also environmental regulations for livestock farms positively affects values.

Keywords: farmland prices, land market, panel data models, farmland values determinants

JEL classification: C23, E32, Q24.

1. INTRODUCTION

In recent years concern over the farmland market has increased across the world. In developing countries land is being purchased by foreign investors – even governments – giving rise to the “land-grabbing” phenomenon. Farmland values in the United States are increasing at the highest rates since the 70s, showing a clear relationship with agricultural price trends. In Europe concerns over farmland prices refer particularly to the possible impact of the Common Agricultural Policy reform process aiming at higher market integration of the European market with the world one, meaning an increased transmission of price volatility to the domestic market. In many countries agricultural prices have been amongst the most important determinants of land values for decades, but the recent increase in price volatility may have modified its relevance in comparison with other factors.

Until the early 2000s, there had been a few studies on the functioning of land markets in the EU, if compared with the USA, mainly due to the lack of reliable time series on land prices and other related factors. Another reason may be the relatively low importance given to this production factor - as capital value *per se* - both in scientific and policy discussions. Only once the CAP policy reform started to significantly affect the level of agricultural subsidies with an increasing distinction between farmers and landowners, the concern about land market started to be involved in the policy debate. It remains not completely clear what is the role of "external" – that is non agricultural - factors on farmland values evolution. The price of agricultural land is clearly linked to the expected returns from farming activities but the behaviour of landowners - either farmers, non-agricultural landowners and companies - is affected by factors outside the agricultural sector, such as economic growth, inflation rate, possible land development and the presence of recreational amenities. In other words, sometimes the farmland capital is conceived more as part of household savings than as production factor.

The Italian farmland market is characterized by all these aspects. Historically Italian land values have been influenced by natural characteristics of the land. Italy has a very diversified territory with marked pedological and climatic differences between lowland, hilly and mountain areas. Moreover the climate is almost continental in Northern regions, while predominantly Mediterranean in Central and Southern regions. Physical characteristics explain the differences in farmland values in absolute terms but if one considers the evolution of the market, other factors have to be analysed to understand the trend in the last decades. The Italian land market is likely characterized by a different perception of the uncertainty of returns on land investments across regions since – during the last twenty years - the difference in average land prices between the North and South of the country has considerably increased.

The aim of this work is to assess the role and the importance of internal factors (agricultural prices, land productivity, *etc.*) as determinants of farmland values in Italy, in comparison to external factors, such as total economic growth, land use changes, and urban real estate trends. Section 2 reviews the existing literature on the determinants of farmland values in the United States and, to a lesser extent, in the European Union. Section 3 retraces the evolution of farmland values in Italy. Section 4 is about the econometric methodology used to perform the analysis, section 5 describes the dataset, section 6 shows and comments the results, while section 7 concludes and provides some hints for future research.

2. LAND MARKET: GENERAL ASPECTS

The literature on the determinants of land values is quite extensive since land – as fixed factor – is very important for farm operators. It can be used as collateral by farmers owing the land they crop and determines the purchasing power of the farmer after retirement (Duvivier, Gaspart, & de Frahan, 2005). The majority of the existing literature on land values relies on the capitalization approach and is mostly about the United States and Canada. According to Ciaian *et al.* (2010) only a handful of studies have investigated the determinants of farmland values in Europe: Traill (1980), Goodwin and Ortalo-Magné (1992) and Duvivier *at al.* (2005). The EU farmland market is much more difficult to investigate than the American one, mostly because it is extremely hard to find reliable and constant data about land values and rents, not to mention actual land transaction, on which most of the American studies are based upon. It is also not easy – for many EU countries – to have data about the amount of subsidies paid to a given country and/or region (NUTS2), a factor that many studies have found to significantly affect land values. The capitalization/present value approach assumes that the price of farmland equals the present value of all future expected cash flows produced by the use of land for productive purposes. Until the 50s the capitalization approach was considered indisputably correct by US economists since the evolution of real farmland value and agricultural income went in the same direction. However, agricultural income started to decrease starting from the 60s, while land value kept increasing and this raised doubts regarding the appropriateness of this approach. Gutierrez *et al.* (2005) utilized panel unit root and cointegration analysis to test whether the present value model holds for a sample of 31 US states during the period 1960-2000. The present value model can in fact be formally tested using cointegration analysis. Results showed that the cointegration hypothesis cannot be rejected if there is a regime shift and the authors conclude the present value model cannot be excluded once one allows for a time-varying discount rate.

Starting from the 80s, several US farmland price studies focused not only on farmland primary price determinants but also on non-farm factors, such as the proximity to urban areas. Non-farm factors have been increasing their importance over time, especially in developed countries, and became – in some cases – one of the most important factors affecting the price of land. Drescher *et al.* (2001) identify the relative importance of farmland price determinants in Minnesota, including, among the explanatory variables, the urban "sprawl", that is the percentage of farmland lost in each county between 1982 and 1992. They found the coefficient of the "sprawl" variable to be positive and significant. In the last decade there have been increasing attempts to better understand land market behaviour using external factors as explanatory variables. Distance to urban centres, urban pressure, the existence of infrastructure and recreational amenities all are important drivers of US land prices (Strotz, 1968); Rosen, 1974; Freeman, 1979). Recently Fleischer and Tsur (2009) analyse rural–urban land allocation in the light of the increasing environmental role of agricultural landscapes, emphasizing the effects of an optimal crop mix on the landscape amenity value of farmland. Cho *et al* (2009), shows that land values in areas close to greenways, parks and water bodies increase over time.

The difficulty to explain the evolution of farmland values only in terms of agricultural factors is not new even in Europe. The recognition of external influences was already known in the XIX century for England and Wales (Peters, 1982) and some evidences about the role of external factors were identified also in Italy (Einaudi, 1934). Johnson (1990) pointed out the inconsistency of the behaviour of farmland prices in the United Kingdom, if the explanations are only based on the evolution of farm income and other standard factors. Non-farming characteristics have to be taken into consideration to justify different prices for parcels of farmland that are agriculturally similar, such as housing development. More recently Jack *et al*. (2009) demonstrate that household behaviour of small scale farms is influenced by expected capital asset returns, alongside lifestyle and profit reasons. In these cases land as a tangible asset is perceived to be a relatively stable and secure investment involving less risk than alternatives such as equities. According to EEA (2010), the drivers influencing land prices are many, and the effects of each of them are not easy to disentangle. Besides the role of agricultural income, other farmland values determinants are taxes, inflation, buyer characteristics, seller characteristics, land size, subsidies, sales regulation, agricultural commodity prices, agricultural productivity, distance to urban centres, urban pressure, infrastructure, option values of future land development, and the existence of recreational amenities.

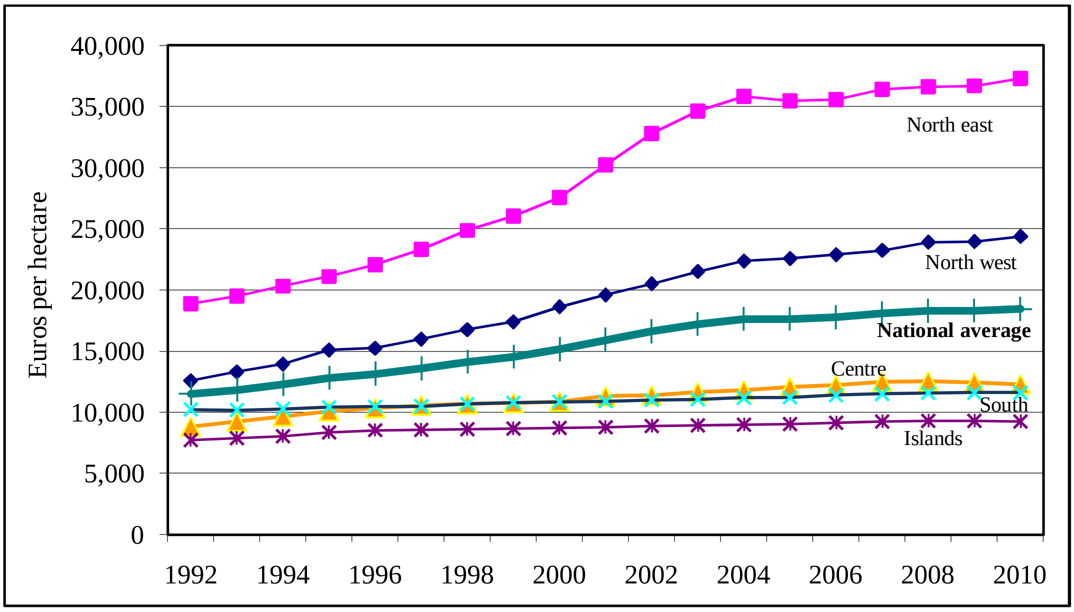
Land values, it has been argued in several papers, might also be affected by agriculture support policies. Even if the primary objective of such programmes is to protect farmers from the inherent market and production risks they face, the payments provided to farmers may also be capitalized into the value of assets such as land (Weerahewa *et al*, 2008). Most of the studies assessing the impact of support policies on farmland values refer to the US, however, recently, Ciaian *et al.* (2010) have examined the extent to which farmer support is capitalized into farmland rents and prices in the EU by analyzing background country reports written by local contributors. CAP subsidies have an impact on land values but this varies substantially across countries and is relatively modest if compared with other factors, especially where land values are high. Moreover, they point out that, after the introduction of the Single Payment Scheme (SPS) the impact of subsidies on farmland values depends also on policy implementation details, market imperfections, and institutional regulations.

The approach followed in our work is similar to that used in Duvivier *et al.* (2005), who estimate the determinants of arable farmland prices using a balanced panel of 42 Belgian districts for the period from 1980 to 2001. In this framework they thought average sale price of arable land (per hectare) to be a linear function of both demand-side and supply-side factor. Demand-side factors are the expected land rent from market sales, the expected land rent from agricultural support, population density, the growth rate of the price of residential land, and pig density by hectare of agricultural area. Supply-side factors are the fraction of arable farmland exchanged in a particular district in a particular year (proxy for market size) and the average area of farms in the district. The authors estimated the model using several different techniques and finally opting for a fixed effect estimator. The authors found that the exchange price of arable farmland is affected by compensatory payments and that the expected land rent from market sales exerts an important effect on arable farmland price, especially before the 1992 CAP reform.

3. THE EVOLUTION OF FARMLAND VALUES IN ITALY

In Italy farmland values have increased by 60% on average during the period 1992-2010, more or less to the same extent as inflation rate (+58%). Land prices showed a steadily increase until 2003-2004, more than the inflation rate, while in recent years the rise of prices was lower than inflation. Farmland prices in Northern regions are 2-3 times bigger than in Centre-Southern regions. Also prices trends differ between the North and the South: values almost doubled from 1992 to 2010 in Northern Italy while in Centre-Southern regions increased by 15-30% only (figure 1).

Figure 1 - Farmland values in Italy by geographic areas (1992-2010)



Source: INEA, Database on farmland values[1]

Besides agricultural factors (soil fertility, climate conditions, irrigation facilities and other agricultural infrastructure) that indubitably explain a significant share of the difference between Italian regions, other factors have arguably played an important role such as: economic growth, land use planning, inflation rate, and environmental policies. Economic growth in the wealthiest regions is likely to have boosted real estate prices with, which effects have spilled over the rural market: Rosato (1991) provided evidence in this direction. Poor land planning increases urban sprawl, therefore inflating agricultural land price through expectations of higher prices due to possible land development (Tempesta and Thiene, 1996). Inflation rate and stock exchange market volatility increase the interest of investors for safer capital values not arbitrarily linked to economic volatility, such as agricultural land. Inflation rate was the main external factor affecting farmland values found by Zuccolo (1991) in the analysis of Italian farmland values 1961-1987. The recent economic crisis and the high volatility of stock exchanges is one of the reasons at the basis of relatively constant values in the farmland markets in last few years. Lastly also environmental policies do have an effect on land values. The so-called Nitrate directive mandates farmers to spread manure from their farms on land only up to a certain quantity per hectare. This has been increasing the demand for land by intensive livestock farmers (mainly pig farms) therefore exerting an upward pressure on land values.

1. [1] An opinion survey on the farmland market is carried out annually by INEA (National Institute of Agricultural Economics) since 1947. INEA identifies several average land prices, based on the survey, at sub-regional scale and calculates an average land price at national and regional level, using a weighting system based on the distribution of agriculture land collected by Agricultural Censuses (Povellato, 1997).

4. METHODOLOGY

In this work we use panel techniques to investigate the determinants of farm land values in Italy, and we regress yearly average farmland values for the 20 Italian administrative regions on an array of explanatory variables for the period 1992-2010. The panel approach has been preferred over a pure time series or cross-sectional one because it allows explicitly modelling time and heterogeneity effects (through the unit-specific effects) obtaining more efficient estimates (more observations), reducing multicollinearity problems (more variation in explanatory variables thanks to the combination of within and between variation), and - most importantly- reducing the potential missing variable bias since unit-specific effects are included in the model.

The two most important and widely used panel regression models are the fixed and the random effects ones. The fixed effects (FE) model is a linear regression model in which the intercept terms vary over the individual units, while the random effects (RE) model assumes that all factors that affect the dependent variable – but that have not been included as regressors – can be summarized by a random error term (Verbeek, 2006).

The RE model exploits the between dimension of the data (difference between individuals) and assumes that explanatory variables are strictly exogenous and uncorrelated with the individual specific effects. The FE estimator exploits the within dimension of the data (differences within individuals) and does not imposes any restriction upon the relationship between the unit effects and the error term (Verbeek, 2006).

Usually the FE estimator is used when the interest lies in the individual effects and inference is with respect to the effects that are in the given sample (*i.e.* countries, large companies, industries). The RE effect approach is preferred when one is interested in making inference with respect to the population characteristics. When explanatory variables are correlated with individual effects (and it seems very much the case when analysing land value determinants) one is forced to use FE since RE is biased. The Hausman test (Hausman, 1978) tests the null hypothesis that explanatory variables and unit effects are uncorrelated. Under the null both RE and FE estimators are consistent but RE is also efficient, while under the alternative only the FE is consistent.

The FE model has the big drawback that does not allow the estimation of time-invariant variables since it uses only the within variation and disregards the between variation in estimation. Even if in this work none of the variables is time-invariant, many of them change much less within the same unit than they do across units. This can be a problem when estimating the model since the FE is inefficient in estimating the effect of variables that have very little within variance (Plümper & Troeger, 2007). Inefficiency does not only translate into low level of significance but also into unreliable point estimates of the coefficients. Plümper and Troeger (2007) suggest an alternative estimator that allows the estimation of time-invariant variables and that is more efficient that the conventional FE model in treating rarely-changing variables. This model is called fixed effects vector decomposition (FEVD) because decomposes the unit-specific effects into an unexplained part and a part explained by the time-invariant or the rarely-changing variables. This method implies establishing *a priori* which variables are time-invariant, which are rarely-changing, and which are changing. Plümper and Troeger (2007) suggest to consider as rarely-changing variables those for which the ratio between the between and the within variance is higher than 2.8. The FEVD involves three steps: in the first one a FE model is estimated on the baseline model (only changing variables), in the second step the procedure splits the unit effects into an explained and an unexplained part by regressing the unit-specific effects from step 1 on the time-invariant and rarely-changing variables, finally the third step consists in a pooled OLS estimate of the full model (containing all variables) including the residuals from step 2 (unexplained part of the FE vector). The third stage allows computing correct SEs for (almost) time-invariant variables. In this stage it can also be controlled for serial correlation of the error term. The FEVD model can be formally expressed as:

$$y_{it} = \alpha + \sum_{k=1}^{K} \beta_k x_{kit} + \sum_{m=1}^{M} \gamma_m z_{mi} + u_i + \varepsilon_{it} \qquad \text{Eq. 1}$$

Where x variables are time-varying and z variables are assumed to be time invariant or rarely-changing. u_i are the unit-specific effects (FE), ε_{it} is the independent and identically distributed error term, α is the intercept and β and γ are parameters to be estimated.

In this work the determinants of Italian land values are assessed through the RE, FE, and FEVD methods. The Hausman test is used to choose which, among the RE and FE model is more appropriate. Since most of the explanatory variables have a very low longitudinal variance during the time span considered the model has been estimated also using the FEVD technique.

Since it is reasonable to think that current farmland values depend upon past values of the same variable (persistence) also a dynamic version of the model – that is including one lag of the dependent variable – is estimated. The dynamic specification used is the one suggested by Arellano and Bond (1991).

Regressions are performed for the whole land market (total utilised agricultural area or UAA), arable land, permanent crops, and vineyards.

All variables are expressed in natural logarithms to both reduce heteroskedasticity problems and to allow the interpretation of coefficients as constant elasticities. They measure the relative change in the dependent value due to a relative change in one of the independent variables. An independent variable's coefficients represent the percent change in the dependent variable due to a 1 percent change in the independent variables, *ceteris paribus*.

5. DATA

The dependent variable is average land values, while explanatory variables are GDP per capita, population density, land productivity, agricultural prices, house prices, yield of real estate investment, and pig density.

The dataset is a balanced panel including average yearly land values for every Italian (20 units) region from 1992 to 2010 (19 periods) for a total of 380 observations. Average yearly land values (thousand euro/ha) for total utilized agricultural area (UAA), arable land, permanent crops, and vineyards are from INEA (*Istituto Nazionale di Economia Agraria*) database as well as data on cropped areas. Population density and GDP figures at regional level were provided by ISTAT (*Istituto Italiano di Statistica*) and SVIMEZ (*Associazione per lo Sviluppo dell'Industria nel Mezzogiorno*).

Land productivity has been calculated as the ratio between agriculture value added and UAA figures, provided by ISTAT. In the case of arable land, productivity has been computed as the ratio between the value of production of herbaceous crops (plus the value of production of livestock production) and total arable land area. For permanent crops land productivity is given by the ratio between the value of production of permanent crops (excluded viticulture) and permanent crop area. Similarly, vineyard productivity is the ratio between the value of production (both wine and table grapes, not separately observable) and total vineyard area. Pig density, as a proxy of relevant environmental regulations, is the ratio between pig population (ISTAT) and UAA.

Since it would have been too complicated and troublesome to get real price figures for each region it has been decided to use implicit prices in the case of the total UAA regression and average prices given by the ration between the value of production and production quantities. For arable land, permanent crops, and vineyards, prices have been calculated through a weighted average of prices for each single crop, weights being the average production value during the 1992-2010 period.

Average house prices and house rents were provided by the Bank of Italy and they were used to calculate the average yield of real estate investment.

All monetary variables are expressed in current terms. It has been decided not to adjust for inflation because it would be necessary to use different deflators for different variables (GDP deflator for GDP/per capita and the consumer price index for prices) potentially modifying the relationship between variables themselves.

Land rents were not included among explanatory variables because in many regions verbal and informal rent agreements are still quite common. It was not possible to obtain data on compensatory payments, which many studies have found to be capitalized into land values, because of confidentiality problems and difficulties to create time series for the 90s.

6. RESULTS

The Hausman specification test rejects the null of no correlation between the unit effects and the explanatory variables in all regressions. It means that the RE yields inefficient estimates and that FE has to be preferred. Results from the FE model are reported in table 1.

Table 1 Fixed Effects Estimates with HAC standard errors.

Variables	Total UAA	Arable land	Permanent crops	Vineyards
GDP/capita	0.68***	0.64***	0.27**	0.76***
Population density	2.13***	1.89***	1.21**	2.35***
Land productivity	-0.11	-0.11	0.05	0.07*
Agricultural prices	-0.08	0.002	0.0001	0.004
House prices	-0.07	-0.02	-0.04	0.04
Yield real estate inv.	0.23	0.29*	0.08	0.38***
Pig density	0.13***	0.14***	0.06*	0.08***
Constant	-3.40**	-2.74*	-1.50	-4.52***
Observations	379	379	379	379
R-squared adjusted	0.9759	0.9856	0.9864	0.9644
DW	0.24	0.26	0.24	0.16
F-test for common int.	212.3***	244.29***	713.76***	256.23***

*,**,*** denote 10, 5, 1 significance level respectively.
Source: own calculations.

Since the Durbin-Watson statistic (DW) is well below 2 – indicating positive autocorrelation of the residuals - the model has been estimated using heteroskedasticity and autocorrelation standard errors (HAC). Significant variables in all regressions are GDP per capita, and population and pig density. Yield from real estate investment is significant in the arable land regression (slightly) and in the vineyard regression. Land productivity seems to have an effect on land values only in the case of vineyards. The magnitude of coefficients seems plausible only in the case of GDP per capita (coefficients range from 0.27 for permanent crops to 0.76 for vineyards) and pig density (higher for arable land and lower and barely significant for permanent crops). The fact that all the other coefficients are not significant and often have the "wrong" sign induces to think that there might be some problem due to the fact that some of the variables have a very little within variance. As Plümper and Troeger (2007) point out FE estimates are inefficient when some of the variables included in the model have little longitudinal variance if compared to between variance. This inefficiency does not only yields wrong standard errors but also unreliable point estimates. The FEVD model overcomes this problem. The ratio between within and between variance has been calculated for all explanatory variables. Plümper and Troeger (2007) suggest to consider as "rarely-changing" variables those with a between/within ration higher than 2.8. Rarely changing variables have to be treated differently during the estimation. Population density (B/W ratio = 27.7), agriculture value added (7.2), pig density (6.26), total UAA land productivity (3.66), arable land productivity (7.83), and permanent crops productivity (3.00) are rarely changing variables. FEVD estimates (with HAC standard errors) are reported in table 2.

Table 2 Fixed Effects Vector Decomposition Estimates with HAC standard errors.

Variables	Total UAA	Arable land	Permanent crops	Vineyards
GDP/capita	0.35***	0.33***	0.13***	0.36***
Population density	0.18***	0.22***	-0.07***	0.09***
Land productivity	0.29***	0.37***	0.50***	0.14***
Agricultural prices	-0.05	-0.01	0.005	-0.01
House prices	0.34***	0.33***	0.18***	0.49***
Yield real estate inv.	0.47***	0.49***	0.21***	0.59***
Pig density	0.10***	0.11***	-0.03***	0.04***
Constant	-1.04***	-1.35***	-0.81***	-0.47***
Eta	1.00***	1.00***	1.00***	1.00***
Observations	379	379	379	379
R-squared adjusted	0.9662	0.9813	0.9847	0.9611
DW	0.13	0.16	0.19	0.16

*,**,*** denote 10, 5, 1 significance level respectively.
Source: own calculations.

The main conclusion that can be drawn from the FEVD results is that agricultural prices do not affect average land values in Italy. This confirms what already emerged from the FE estimation. The coefficient for agricultural prices is not significant in any of the regressions. A possible explanation to this fact is that during large part of the time span taken into consideration the EU was heavily subsidizing European farmers with coupled payments therefore reducing the importance of agricultural prices when it came to evaluate farm land. These results are in contrast with those of the existing literature, even if it has to be acknowledged that “prices” used in this work have been derived from the total value of production and are not the result of actual transactions.

For total UAA the most important land value driver is the yield from investment in real estate. A 1% increase in real estate investment profitability triggers a 0.47% increase in land values. This might be explained by the fact that the yield from real estate investment can be interpreted as a measure of investors’ expectations towards further increases in prices in similar markets (building land), which can spill over to the farmland market. In the late 90s/early 2000s the real estate price bubble that interested many areas especially in Northern Italy, also positively affected farmland prices. GDP per capita and house prices have a strong influence on total land values: their coefficients are 0.35 and 0.34 respectively. Regions characterized by a high GDP per capita are also those more likely to have a strong, structured, intensive, and therefore more profitable agricultural sector. This translates into higher demand for land (which supply is by definition limited) and higher land values than in relatively poorer regions. Population density - a proxy measure of urban pressure on land values- shows a relatively lower coefficient (0.18) than other non-agricultural factors. Another important determinant of farmland prices is land productivity, which represents potential profits obtainable from it. Land productivity has a high and positive coefficient (0.29). Also pig density plays a role in determining farm land prices: a 1% increase in pig density means a 0.11% increase on farm land values, similarly to what Duvivier *et al.* (2005) found (a 1% increase in pig density triggers a 0.1% increase in farm land values).

For arable land, coefficients are comparable – both in sign and magnitude – to those of the total UAA regression. The only differences being the stronger importance of land productivity (0.37) and population density (0.22). This similar outcome can be explained by the fact that more than 55% of total UAA is arable land. Productivity is very important to determine the value of a piece of land especially when it comes to arable land and (as we will see later) permanent crops. Nowadays in order to be economically sustainable the cultivation of cereals, vegetables, fruits, and citrus require fertile land and a great extent of agronomic care. Land productivity is less important in the case of vineyards since they can be implanted also in relatively infertile soils. The high population density coefficient is in accordance with *a priori* expectation since most of arable land is located in flat areas, never too far from urban centres.

The picture changes quite substantially when it comes to permanent crops, which are very important in Italy (18% of the UAA, taking into account also vineyards), especially if compared to other European countries. In this case the most important factor affecting prices is land productivity, which coefficient is as high as 0.50. Urban pressure is much lower than for total UAA and arable land since a large share of permanent crops (orchards and olive and citrus groves) are located in hilly or mountainous areas, where the demand for building land is usually scarce. The impact of house prices and the expected yield from real estate investment is positive but lower than that exerted on arable land, coefficients being 0.18 and 0.21 respectively. Also the role of GDP per capita is lower: a 1% increase in GDP per capita increase permanent crops value by 0.13% almost one-third of the effects exerted on total UAA and arable crops. This is explained by the fact that 88% of Italian permanent crops are located in central and southern regions, which are also the less rich of the country. Population and pig density do have significant coefficients but they are negative and very close to zero. Hilly areas, where permanent crops are located, are also those more scarcely populated and intensive piggeries are all located in lowland areas.

The main determinants of vineyards values are yield of real estate investment (0.59), house prices (0.49), and GDP per capita (0.36). As a matter of fact, even if also vineyards are more abundant in hilly areas of central and southern regions (66%, but a considerable part of them is used for table wine and grape production) the most valuable ones are located in Northern Italy (especially Piedmont and Veneto, where some of the most expensive Italian wines are produced). Those areas – not too far from the main urban centres – are characterized by a high demand for houses, especially luxury ones. Population and pig density play little role – similarly to what happens for permanent crops – and it is surprising the relatively scarce influence of land productivity on vineyard values (0.14). These results are more or less in accordance to what one could have expected *a priori*, except than for the fact that it seemed reasonable to think that wine prices had an effect on vineyard prices. A possible explanation is that prices used are a weighted average of wine and table grapes prices since it was not possible to discriminate between vineyards for wine production and table grapes production.

Finally a dynamic version of the model has been estimated using the Arellano-Bond technique (Verbeek, 2006). The model is augmented with one lag of the dependent variable. Lagged farm land values have a very strong effect on current farmland values (between 0.81 and 0.85) meaning that values tend to "repeat themselves" from year to year. This is due to the fact that prices used in this work are not from real market transaction but the outcome of personal interviews that INEA's surveyors perform on local farmland market operators. In the dynamic regressions the inclusion of a lagged value of the dependent variable strongly reduces the significance of the other variables, except than for GDP per capita in the total UAA (0.11) and vineyards (0.23) regressions. Land productivity is (barely) significant only in the total UAA regression but the coefficient is very close to zero. Very surprisingly the coefficient of agricultural prices becomes significant (even if quite close to zero: 0.06) in the total UAA regression.

7. CONCLUSIONS

The main result that emerges from this work is that agricultural prices do not affect average land values in Italy. This outcome is in line with the *a priori* expectations, at least for total UAA, arable land, and permanent crops regressions. We were expecting a positive influence of agricultural prices on land values in the case of vineyards but it was not the case. A possible explanation lies on the fact that "agricultural prices" and vineyard values used in this work are a weighted average of labelled high-quality wine, table wine, and table grapes prices. This may have undermined the results. It would be therefore interesting to estimate another version of the model regressing the price for vineyards used for high-quality wine production on the same explanatory variables and the price of selected high-quality wines representative of the viticulture sector of each region.

The most important land value drivers are the yield of real estate investment, GDP per capita, house prices and land productivity. Yield from real estate investment can be interpreted as a measure of investors' expectations towards further increases in prices in similar markets (building land), which can spill over to the farmland market. GDP per capita is particularly important for ala land types (except than for permanent crops), while population density, as a proxy for urban pressure, is important especially for arable land, while its influence is almost negligible for permanent crops and vineyards. This is due to the fact that arable land is generally located in flat areas, where the demand for land (mainly for building purposes) is higher.

House prices, similarly to what happens for GDP per capita and population density, have a greater impact on arable land and vineyards than for permanent crops. Demand for houses is higher in flat areas (where arable land is located) and in the surroundings of urban centres. The particularly high house price's coefficient for vineyards should not surprise since generally vineyards are located in hilly areas but never too far from urban centres that is places where the demand for luxury houses is quite strong.

Land productivity turns out to be the most important "agricultural" determinant due to the high demand for land characterised by good fertility. As expected, pig density plays a not negligible role in explaining arable land values since intensive piggeries, located in flat areas, in order to comply with the European nitrate directive, contribute in increasing demand for land.

Summarizing, it can be affirmed that land values, in Italy, are mainly determined by possible alternative uses of land. Farmland in many areas of the country is viewed as a “land reservoir” to which draw when it is needed. Demand for land by farmers is relevant only where the agricultural sector is well structured and able to generate stable and large cash-flows, that is in the flat, well-endowed (in terms of infrastructure) areas of Northern Italy. Even if the entire country is characterized by the presence of high quality agrifood products, it seems that the additional value added that they are able to generate does not translates into higher land values. The main limit of this work is that was not possible to include neither land rents nor average subsidies per hectare paid to farmers in each year. Evidence from the literature about the degree to which agricultural subsidies are capitalized into land values has been mixed but it is reasonable to think that they may have an impact. Also land rent are likely to influence land values but the Italian rent market is far to be transparent since in many areas (not only remote ones) verbal agreements are still quite common. Urban pressure, here proxied with population density, would have been better expressed by an index representing urban sprawl but scarce data availability (even geo-referenced) induced us to desist in the idea of computing it. Finally it was our intentions to include also a variable representing climatic conditions in each region. We think that climate change, which in a Mediterranean country like Italy translates into an increasing risk of desertification, might change operators’ attitude towards investing in farmland and/or their willingness to pay for it. Unfortunately data needed to build the aridity index we thought to include in the model were not easily available.

To the best of our knowledge this work is the first one attempting to assess farmland drivers in Italy and has to be therefore regarded as a starting point for further research. We reckon that more precise results can be obtained both improving the dataset and applying more sophisticated econometric techniques such as panel allowing for structural breaks and cointegration analysis.

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