The role of farmers' competition on farmland price in local markets: Bretagne region of France

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Abstract

We introduce the local farmland market concepts in order to understand the operation of French farmland sale market. We perform an empirical analysis of farmland prices based on farmland sale market in the Bretagne Region of France. The descriptive statistics show that the price of farmer to farmer transactions is significantly higher than the non-farmer to non-farmer transactions by almost €830/ha. The log-linear estimations indicate that farmer sellers have higher bargaining power than non-farmer sellers. Because of the competition between farmers, when the sold area share of farmers increases by 50% at the municipality level, the price increases by €488/ha. Symmetric significant effect is measured on the demand side. For example, if the traded area share of farmers increases by 50% in the municipality, the price decreases by €172 /ha. The result on the supply side of traded land also reflects the higher willingness to accept (WTA) of farmers and the result on the demand side reflects a pure market power effect, since the farmers' willingness to pay (WTP) is usually higher than non-farmers' WTP.

Key words: local market, bargaining power, market power, farmland prices

JEL code: Q12 Q15 Q150 D43

Introduction and motivations

Farmland is one of the basic inputs for agricultural production. Compared to other factors of agricultural production, farmland is a distinctive factor of production because of its non-reproducibility, spatial fixity, and immobility characteristics. The typical land market features are usually different from other commodity markets as heterogeneous properties of a plot are traded between heterogeneous economic agents. As a result, the standard market price approach that assigns the same price for a relatively homogenous product may not provide the true value of farmland.

We argue that the French farmland market depends on the functioning of fragmented and much localized markets because the French farmland market is subjected to different national regulations and European based agricultural policies (Ciaian et al. 2012; Latruffe et al. 2013). The French Land Use and Rural Settlement Corporations (Sociétés d'aménagement foncier et d'établissement rural) or SAFER are Regional land offices, which aims at monitoring and shaping farmland sales according to specific objectives of the French government and consistently with agricultural policies. The classical 1945 French farm tenancy law still operates and provides many privileges to the active tenant farmer over non-operator landowner. As the result, by now, the tenanted area share is now more than 60% of the French farm area. It belongs to non-operator owners, who in many cases inherited their land rather than bought it (Courleux 2011; Ciaian et al. 2012).

The focus of this paper is studying the farmers' competition effect on farmland price in predominantly agricultural areas. In France, farmers are buying almost 70% of the nationally farmland traded area while non-farmers are supplying 67% of total traded area in the year 2000-2007 (Courleux 2011). Farmers are capitalizing the agricultural profit, which is derived from production while non-farmers are capitalizing the cash rental income by renting out their land to the tenant farmers. In the favor of tenant farmers, French tenancy laws set

minimum and maximum rental price indices at French 'department'[1] level. The law states that the annual rental price between the tenant farmer and her landowner should fall between these administratively set price ranges. We propose that if the cash rent is undervalued as compared to the agricultural return, then farmers' behavior will be different from non-farmers' behavior on farmland sale market and response of these economic agents to policy and regulation instruments will also differ.

The main objective of this paper is therefore to measure the role of farmers' competition on farmland price formation in the Bretagne Region of France. Bretagne is the leading agricultural region in France. However, the regional farmland faces strong urbanization competitions, which are induced by the regional demographic dynamism and extensive peri-urbanization pressure (diffusion of urban life style and new residential zones) in one side and the environmental land use regulations (coastal zone managements and nature conservation) on other side (see among others., Cavailhés et al. 2003, 2011; Lefebvre and Rouquette 2011; and Dachary et al. 2011). This paper focuses on the farmland sale prices in the agricultural areas. In the predominantly agricultural areas, although net return to land is the main determinant of farmland price, little is known about the role of farmers' competition on the price formation at a local scale.

We follow a two stage approach: conceptual development and empirical investigation. The conceptual framework focuses on literature and theories of imperfect market functions. The empirical investigations rely on statistical analyses at canton and municipality levels and individual log-linear farmland price estimation using a locally constrained sales market model. Conceptually, we describe the local farmland market using a micro-economic interactive farmland sale model. For the conceptual framework, concept of market power and

[1] According the French administrative territorial classifications, the departments ("*départements*") refer to sub-regions of "régions" in the metropolitan France. The "*départements*" are further sub-divided in two districts ("cantons"), and then these cantons are finally sub-divided in many thousands of municipalities ("communes").

bargaining power are two typical features of imperfect market competition. The market power of the local market can be defined as the ability of an individual to impose direction of the final transaction prices according to the market structure of the local market. The bargaining power on other hand is the capacity of an individual to influence the transaction price within a local market according to the characteristics of sellers and buyers such as the age, sex, sociological and occupation of the seller and buyer: being a farmer or not in this case.

The empirical procedure invokes the statistical analysis related to farmland price formation into two ways: First, we do a statistical description. The farmland sales are rigorously described in order to identify the scale of localized farmland market in the Bretagne region. Second, we perform log-linear estimation of each individual transactions price according to the local constrained sale market model.

Following this introduction, the remainder of this paper is structured as follows: Section 2 presents the summary of the literature review and the conceptual farmer's bargaining and market power effects on farmland price formation are discussed graphically. Section 3 discusses the data description and characteristics of Bretagne's farmland sales. We discuss the pair-wise comparison statistical results of the local farmland market. We measure farmers' competition on the individual farmland price level using locally constrained farmland sale model in Section 5. We measure the role of farmers' and non-farmers' respective bargaining powers, which are driven by the market power on the local market, the sellers' and buyers' characteristics and economic agents' competition. Finally, Section 6 provides the summary and conclusion of the main findings.

Literature and theoretical review

Literature review

The hedonic farmland price method is formulated using the original model of Rosen (1974) methods considering that farmland is a differentiated product. According to Rosen, the implicit and explicit attributes of farmland can be valued by a regression of its price over these characteristics and attributes (Palmquist 1989: 2005). Extensive previous theoretical and empirical research has been conducted to identify the drivers of farmland prices using hedonic methods (Livans et al. 2007; Palmquist and Danielson 1989; Ma and Swinton 2012). Most of them have employed the standard hedonic pricing method, which treats farmland as a differentiated product. The hedonic literature takes the restrictive assumption in studying and analyzing the formation of prices about heterogeneous goods (Rosen 1974; Epple 1987). The bargaining of a heterogeneous good defines a shadow price, which is known by both buyers and sellers at the time of transactions.

In Rosen model, bargaining power and market power have no effect on the formation of prices. However, with a finite number of buyers and sellers of farmland, both the number and the characteristics of participants affect the price formation processes. This potentially leads to market power. The question of farmland price formation and its consequences with finite number of agents remain the silent features of farmland price literature. Very little literature exists in other property markets, mainly in house market and urban land market context. It relies on Nash equilibrium model but diverge from the standard competitive principle. These kinds of analyses are very limited in farmland literature.

In addressing the inefficiency of markets, classically one has to introduce information asymmetry, the search processes or the transaction cost theory for understanding the functioning of real estate and land markets (see e.g., Stiglitz 1987; Evans 2004).

The search model focuses on the effect of search costs and matching difficulties to determine the final transaction price of a good for sale. Stiglitz (1987) argues that with increasing number of agents in the market and with increasing marginal search cost, imperfect information would make the market less competitive. Tavernier and Li (1995) attempt to construct a search theoretical farmland price model to examine the farmers' decision to sell or not. It depends on the opportunity cost of the subsequent future net forgone agricultural income against the current price of farmland. Similarly, King and Sinden (1994) developed an empirical sequential model that accounts for the search for buyers and sellers and that handles the information asymmetry between seller and buyer and its effect on their respective bargaining positions.

The second line of literature is analyzing the price formation under small number of agents, which is the main interest of this paper. Individual bargain power and market power are also conical terms related to small number of agents in a given market. In housing market, Harding et al. (2003a, 2003b) introduced the theory of bargaining on hedonic price formation. The authors extend the work of Rosen (1974) hedonic models to explore the impact of bargaining power on the American house prices. They found that household wealth, gender and other demographic traits influence bargain power and therefore the negotiated prices. They explain that the weak buyers pay higher prices and the weak sellers receive lower price for their homes. Cotteleer et al. (2008) applied bargaining power of seller and buyer according to Harding et al. (2003) specification in application for the Netherland farmland markets. Their focuses were on the number of potential buyers relative to sellers in their predefined local market. The authors derived the market power of a local market according to the difference between the number potential buyers and the number of potential sellers.

Therefore, this study is conducted with these precedent ideas; however, we argue that the individual bargaining power and market power is determined in three ways. Firstly, we will not consider the search cost as an issue for bargaining power effect unlike to the work of King and Sinden (1994), because the seller and buyer can find each other easily in a very small defined local market. Secondly, we consider that the effect of bargaining power is determined according to seller and buyer characteristics, objectives and goals unlike to the work of Harding et al. (2003) who assumed that only personal characteristics affect the bargaining power of seller and buyer. We define seller and buyers characteristics by demographic and sociological characteristics, occupation of sellers and buyers. Thirdly, we consider that the market power should be analyzed in detail based on the market structure of each locality. We define the market structure of the local market by concentration of sellers and buyers and the concentration of farmer buyers/sellers and non-farmer buyers/sellers. Therefore, we argue that the individual bargaining power and market power may interacting each other to influence the direction of final transaction price that should be reached between seller and the buyer.

Conceptual framework

This section presents a conceptual design to understand how localized farmland market functions when farmers and non-farmers buy and sell in a given geographical area. Overall, the sales market of farmland can be described in three stages. The first stage is connecting potential buyers and sellers. The second stage is negotiating prices. The final stage is exchanging and transfer of ownership from seller to buyer. The focus of this section is to conceptualize on the latter ones, which analyze the mechanism of farmland price formation when random trading partners are interacting in a given locality area. However, either the sellers or buyers may get the gain from trade according to their marketing power of farmers

over the non-farmers. We consider a limited number of farmers and non-farmers in the market model as a reference for local market competition.

Two buyers –one seller farmland price model

Assume that, one unit of farmland is offered for two potential farmer buyers in a given small market area. We argue that in order to have a feasible transaction, the reservation price of the seller P_r^1 should be lower than the offered prices of the two potential farmer buyers respectively denoted $P^o{}_1$ and $P^o{}_2$. If we further assume that the offered price of the second farmer is lower than the first farmer $P_2^o \prec P^o{}_1$, there will be a transaction between the first farmer buyer and the farmer seller. The presence of the second farmer in the market narrows the negotiated price between the two bids of the potential buyers $P_1^o \prec P^* \prec P_2^o$ because of the competition among farmer's buyers; the transaction price will not fall below the offered price of the second farmer $P^0{}_2$. Given this competition, the bargaining room shifts from (CC') to (CC"), between the range of the offered price the second farmer buyer $p_2{}^0$ and the offered price of the first farmer buyer P_1^o .

From Figure 1, the difference between farmers' WTP are close and so are their bids p_1^o *and* p_2^o . If the two buyers are compete with each other, the difference between $p_1{}^0$ and $p_2{}^0$ will be relevant and significant for determining the final transaction prices. The difference between the seller's WTA and the buyers' WTP becomes irrelevant because, to be sure to win the competition, the first buyer must bid above the second buyer's WTP.

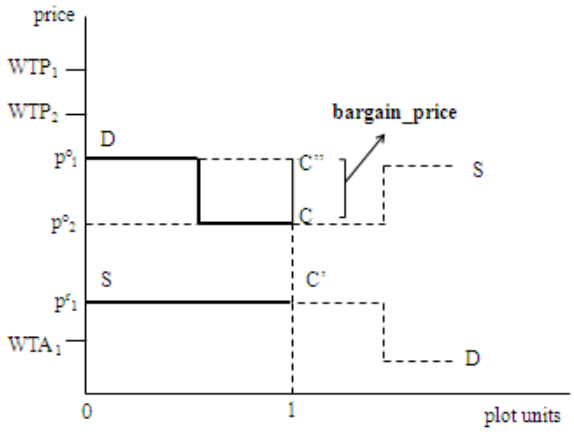

Figure -1 Graphical illustrations of two buyers by one seller

Following this line of argument, we can formulate the general rule of determining the number of transaction and transaction prices. The precise level of the price depends on the relative market power of each side. If the sellers have higher bargaining power than the buyers, due to sociologic factors, occupation, personal situations, the price will increase in favor of the sellers. Similarly, if all buyers have higher bargaining power than the sellers, the final transaction price favors the buyers. If sellers and buyers are homogenous in the local market, the competition effect overweighs the bargaining effect. For example, if all sellers asking and buyer offered prices are very close from each others, the bargaining room is reduced. If say for example, transactions are conducted between farmers only, and if the numbers of buyers and sellers are equal, the competition effect outweighs the bargaining effect.

The above hypothetical farmland price analysis is the simplest representation of the complex interactions between heterogeneous agents and heterogeneous units of farmland. Here, the main objective of this paper is to understand and assess imperfect competition of farmers in a given local farmland market. Usually, few plots of farmland are for sale in a year for a relatively large number of potential buyers. The next section gives the farmland market description of the Bretagne region.

Description of data sources and statistical analysis

Data source and sampling

We study Bretagne farmland markets. The analysis is based on French notaries data base (PERVAL). PERVAL data set is designed to produce and mange the actual sales prices for all property markets including farmland sales. We accessed 19,873 individual farmland sales from 1994 to 2010. The main objective of this paper is to characterize the farmers' market power at a local farmland sales market in the agricultural predominate areas, which have less influenced by urban pressure. Therefore, first, we sampled only farmer and non-farmer transaction and we exclude all transactions of SAFER interventions or administrative purposes. We assume that these transactions are exceptional to the rule and the function of the local market. Second, for the same reason, we exclude all sales transactions below 3 hectare per one unit of transaction, transactions that fall below €500/ha and beyond, €13,000/ha. All relevant variables are categorized in four main categories (See in Annex_2) and all price variables are deflated by 2005 French Consumer Price Index (CPI).

Farmland prices and sales area in Bretagne region

The number and volume of transacted sales were increasing in Bretagne over the observed past 17 years. In total, about 4.25% (76,499 ha) of UAA farmland were offered to the market and transferred from one owner to another. On average, about 4 hectares was sold per transaction and the average price of farmland was falls between €3,000 and €4,500/ha. The average sales turnover rate was less than one percent (about 0.27% of UAA)[2] per year. The minimum transacted plot area was a quarter of hectares (0.15 hectares) and the maximum was 73.95. The mean sell area (4 hectare) is greater than the median sale area (2ha).

[2] This is by far, less than the average sales transaction rate at national level. In France metropolis, the annual sales transaction rate is estimated about 1.37 % of UAA (Courleux 2011).

Using the same data base, we classified and examined the occupation of buyers and sellers in to four categories as farmers whose main activity is agriculture, non-farmer whose main activity and who are currently employed outside agriculture activity, SAFER, and public administrative. Farmers purchased more than 75% of the market share. Non-farmers on the other hand, sold more than 65% of total number and sale area of transacted farmland over 17 years period. We found that the involvement of SAFER as the seller and buyer in market is relatively below the expectation. SAFER bought only 2.4% of the total transaction and sold 3.7 % of region total transaction from 1994 to 2010.

Description of the location of buyers and sellers

As a part of data description, we also examined the residence location of sellers and buyers from their traded plots at the regional and department levels to the lowest administrative levels (cantons and municipalities). Regionally, as expected, a significant number of 16,480 (83%) sales were conducted by sellers and buyers who live within Bretagne. The inter-departmental and intra-departmental farmland trade transaction shows that, more than 87% of respective total department transactions were conducted by sellers and buyers who live within their respective departments. We also study spatial allotment of sellers and buyers relative to their traded farmland for 184 cantons and 1,184 municipalities. The results show that more than 83% of buyers and traded plot were found in similar canton areas. Similar to canton results, about 76 % of the total buyers reside with the same municipality area of the traded plots.

The pair-wise comparison tests are also performed to compute the margins comparison prices difference across different transaction pairs. The results has shown that the mean price difference of farmer to farmer transactions and non-farmer to non-farmer transactions is about €831/ha with statically significance level for untenanted farmlands markets but not statically

significance for tenanted farmlands. The result is as expected as the competition effect is more intensive and stronger in untenanted farmland market than in tenanted farmland market.

The above statistical results strengthen our argument that the local farmland is subjected to the competitive behavior between farmers and non-farmers. This results has also shown that farmers' WTP/WTA is higher than non-farmers' WTP/WTA particularly for untenanted farmlands. Therefore, this leads that the bargaining power of farmer could be higher than the bargaining power of non-farmers. The effect of farmers bargaining power and competition on final transaction prices are analyzed in the following section.

Empirical farmland price analysis at local market model

As we recalled in the introduction, the main aim of this paper is to investigate how these bargaining and market power of famers' competition is reflected to individual level transaction prices. In this section, we examine the effect of the individual bargaining power and market power in detail by distinguishing farmers' dominated local market from non-farmers' dominated local market. As explained in Section 2, the theoretical model employed in this study is based on the precedent ideas of Harding et al. (2003), King and Sinden (1994) and Cotteleer et al. (2008). We analyzed here, for the case of France and using different assumption, when buyers and sellers are restricted to a certain geographical areas and when non-farmers' cash rental income is different from farmers' return to farmland due to French regulations. The local markets we consider here are characterized as a thin market where a few number of sellers and buyers negotiate each other. The market power effect is unavoidable and its effect on operation of the market and on final transaction price should be well investigated in related to local farmland market model.

To analyze this, we propose that the sale price of farmland is determined by three elements: the vector of plots' bio-physical characteristics, the bargaining power and the market power of seller and buyers in the local market area. This is represented as follow:

$$P(Z) = (Z(z_i,,,,z_T), b_m, LM_n) \quad \ldots. (1)$$

Where $P(Z)$ is market price of a plot of farmland, (z_i) is a vector of T units of bio-physical characteristics of the transacted plot land, (b_m) vector of m buyers and sellers characteristics for measuring individual bargaining power, and (LM_n) is a vector of local market structure with n number of constructed market power indexes, which are computed at canton and municipality level.

For simplification, assume that there is a linear speciation holds between independent variables and prices. Equation (1) can be expressed as:

$$P(Z) = \sum_{i=1}^{T} s_i z_i + \sum_{m=1}^{m} b_m + \sum_{n=1}^{n} LM_n + e \ldots. (2)$$

In this specification, s_i the slope parameters related to the bio-physical characteristics such as soil type, drainage, layout, slope, including accessibility of farmland, denoted by vector of z_i indicators, b_m refers to seller and buyer characteristics (individual bargaining power), LM_n local market characteristics (marker power effect), and e is the error term.

Individual bargaining power (b_m)

Individual bargaining power is the capacity of an individual to influence the transaction price within a local market. We consider the characteristics of sellers and buyers, their respective occupation, and the relative number of the different categories determines the competing forces operating in a local market. In Equation (2), the second term (b_m) is buyer and seller characteristics (such as age, gender, occupation, experience, etc.) that may influence the bargaining power of sellers and buyers in the imperfect local farmland market context. These characteristics are assumed directly influence the level of the bidding price of buyers and the offered prices of the sellers during their bilateral trade negotiation process. In

order to estimate the effect of the bargaining effect of sellers and buyers, we defined further individual bargaining power (b_m) as follow:

$$b_m = b^{seller} S^{seller} + b^{buyer} B^{buyer} \quad \ldots\ldots (3)$$

In Equation (3), b^{seller} and b^{buyer} are vector of coefficients that measure individual bargaining power of the sellers and buyers, respectively. S^{seller} is the vector individual seller characteristic, and B^{buyer} is the vector of buyer characteristics.

The market power (LM_n)

The last term (LM_n) refers to the market power that characterize the behavior of local markets. Local market power proxies such as the number of sellers and buyers, non-farmers seller and buyer concentration, and the volume of total sales are considered. As explained in Section 2, the market power is the ability of an individual to impose and determine the final transaction prices. This is determined by the characteristics of seller and buyer and the market structure of the local market. We propose that the market characteristics of each local market are different from one local area to another local area, which is determined by the intensity of farmers' competition for farmland. Therefore, we define the local market function in two scenarios, the difference between the total number of sellers over buyers, and the difference between farmer sellers/buyers over non-farmer sellers and buyers in a locality.

Considering the above assumption, the market bargaining power can be expressed using the following equation:

$$LM_n = d\ (N^{\ seller} - N^{\ buyer}) + c\ (N^{\ farmer} - N^{\ nonfarmer}) \ldots. (4)$$

where d refers to the parameter that measure the seller market power relative to the buyer market power, $N^{\ seller}$ is the market share of sellers in local market and $N^{\ buyer}$ is the market share of buyers in the local market. Therefore, difference between the market share of sellers and the market share of buyers in a given local market is defined by $(N^{\ seller} - N^{\ buyer})$. If

$(N^{seller} - N^{buyer})$>0 zero, the market share of sellers are greater than the market share of buyers, and if $(N_i^{seller} - N_i^{buyer})$ < 0 the market of share of buyers are greater than the market share of sellers. c_i is a parameter that measures farmer seller market share relative to non-farmer seller market share, N^{farmer} is the market share of farmer seller/buyer, $N^{nonfarmer}$ is the market share of non-farmer seller/buyers in a given locality. $N^{farmer} - N^{nonfarmer}$ is the difference between farmers' market share over and above non-farmers' market share. If c is positive, farmer seller/buyer has a market power against non-farmer and if c is negative, non-farmer seller/buyer has a market power than farmer. We have developed indexes for all market power proxy.

Substituting Equation (3) and (4) into Equation (2), provides us the farmland price formation with individual market bargaining and local market power effect (5)

$$P = s_i z_i + b^{seller} S^{seller} + b^{buyer} B^{buyer} + d\ (N^{seller} - N^{buyer}) + c\ (N^{farmer} - N^{nonfarmer}) + e \quad \ldots. (5)$$

where e are the composite error terms of all errors defined in above equations and all the other variables and parameters are as previously defined.

Description of market power variables

As we discussed above, the size of a local farmland market is defined based on the residency location of sellers and buyers relative to the trade plot location. The definition of these variables is explained in Annex-1. In total, about 6,004 sales transactions were used for this estimation, which are supposed to be agricultural purpose transactions. We perform the regression by distinguishing the tenure status: tenanted and untenanted farmland. Every local land market is estimated using three models. The dependent variable is the logarithm of the sales price per hectare. The independent variables are categorized into two different groups: non-market related variables and market related variables as explained in Annex-2.

Non-market related variables are commonly determinates of farmland price. The influence of these variables is related to the basic return to farmland, derived from within agriculture or outside the agricultural sector. These variables are not directly related to the market situation by assumption. The variables under this category are agricultural profitability, urbanization or non-farm income opportunity variables.

Market related variables which are related to the market characteristics of the land sales market. If the market is perfect and complete, the effect of market variables on farmland price would be reduced or minimal. However, in the regulated farmland market and local land sales market, the effect of these variables would be significant. The main objective is to identify the market related variables role in shaping the final transaction price that should be reached between the seller and the buyer. These variables are either related to individual bargaining power (b_m) and the market power (LM_n). We consider the market related variables: Seller/buyer characteristics that influence the individual bargaining power, location of sellers and buyers relative to the traded plot and local market power constructed indexes as defined in Table-1. The detail definitions and summary of statistics of variables are included in the estimation of farmland price formation model.

Table - 1 Definition and formulation of market power indexes

Symbol	Definition	Unit
N	total number of transaction by canton/municipality	Number
A	total sales area in hectare by canton/municipality	Hectare
NS	number of sellers canton/municipality	Number
NB	total number of seller in canton/municipality	Number
NSBT	number of transactions by sellers and buyers who resides in same canton/municipality area	Number
NNSBT	number of transactions by seller and buyers who resides in different cantons/municipalities	Number
NFS	number farmers seller by canton/municipality	Number
NNFS	number of non-farmer seller by canton/municipality	Number
NFB	number of farmer buyer of by canton/municipality	Number
NNB	number of non-farmer buyer by canton/municipality	Number
AFS	sale area share of farmer seller by canton/municipality	Hectare
ANFS	sale area share of non-farmer seller by canton/municipality	Hectare
AFB	sale area share of famer buyer by canton/municipality	Hectare
ANFB	sale area share of non-farmer buyer by canton/municipality	Hectare

Index calculations	
seller number index(MKP_1)	(NS-NB) /N
seller-buyer location index (MKP_2)	(NSBT-NNSBT) /N
farmer seller number index (MKP_3)	(NFS-NNFS) /N
farmer seller area index (MKP_4)	(AFB-ANB) /A
farmer buyer number index (MKP_5)	(NFS- NNFS) /N
farmer buyer area share index (MKP_6)	(AFB-ANFB) /A

As we discussed earlier, the above constructed six indexes for measuring the market power of sellers and buyers in addition to sellers and buyer characteristics. These are designed to measure the market power of sellers as compared to buyers in given local area and to measure the market power of farmers relative to non-farmers. One can note that all these indexes are based on the demand and supply sides of the actual buyers and sellers who had successfully traded each others, respectively. We do not take into account the potential sellers or buyers, which we cannot observe from the data set. If the potential buyer were equal to the potential seller in given area, this will not be a problem as the difference, would be cancelled out each other. The net effect is remaining observed in actual seller minus the actual buyer. However, if the potential buyer is higher than the potential seller, we may face unobservable effects. This is true when there were many bidders for a single seller or when there were many sellers to a few buyers. In most commonly farmland sales market, we assume that there would be many buyers relative the sellers. For this reason, we take farmers' density as measure of potential buyer in the regression. Farmers' density computed as the total number of population per 100 hectare of UAA. Table-1 provides the detail definition of these developed indexes.

Seller number index (MKP_1): MKP_1 is the numbers of sellers, relative the numbers of buyers in a local market. Location seller index (MKP_2) is designed to answer the location bargaining power of buyer and sellers related to the traded farmland. If MKP_2>0**,** many of sales transaction have been undertaken by sellers and buyer who resides in the same local

area. Farmer seller index (MPK_3) designed to measure the competitiveness of farmer seller relative to non-farmer seller. It is calculated as the difference between number of farmer seller and the number of non-farmer seller. If MPK_3 is greater than zero, the number of farmer seller is greater than the number of non-farmer seller. If MPK_3 is less than zero, the numbers of non-farmer sellers are greater than farmer seller. In the bound cases, if it is equal to one, all sellers are farmers (farmers' monopsony[3]), while if MKP_3 equal to minus one, all sellers are non-farmers (non-farmers' monopsony).

Farmer seller area index (MKP_4) measures the market share of farmer seller relative to the market share of the non-farmer seller of the total traded area of farmland. Farmer buyer number index (MKP_5) measures the difference between the number farmer buyer and the number of non-farmer buyer market share relative to the total number of transacted lands in the local area. Farmer buyer area share index (MKP_6) is also designed to measure the market share of farmer buyer and non-farmer buyer related to the total traded area of farmland.

The statistical descriptions of the results are reported in Table 2. The descriptive statistical shows that about 6.68% of municipality's UAA and 13.0% canton's UAA were traded over 17 observed years. The average farmers' density is measured by 100 hectares of UAA, on average there are about two or more farmers are operating. The descriptive statistical of MKP_1 indicates that the number of sellers on the average 29% and 34% lower than the number of buyers in canton and municipality, respectively. Similarly, the value of MKP_2 also indicates that 33% of transacted plots and 13% of total transacted plots were conducted by sellers and buyer who resides in the same canton and the same municipality area, respectively.

The descriptive of MKP_3 also indicate that the number of farmer seller is 31% and 45% less than the number of non-farmer seller in canton and municipality, respectively. The

[3] The classic definition of monopsony refer to when a single supplier with many buyer. In this case when either a single or many farmers are supplying the whole traded farmland for particular local area (canton or municipality), we call it farmers' monospony.

MKP_4 also shows that farmer seller sale area share is higher than non-farmer seller sale area share by 50 % and 44% in canton and municipality, respectively. Similarly, the values of MKP_5 indicate that the number of farmer buyer is 14% and 43% lower than non-farmer buyers in canton and municipality area, respectively. On the other hand, the MKP_6 also indicate that farmer buyer area share is 38% higher than non-farmer buyer area share. This is a good indication that farmers presented in market in a smaller number than non-farmers while they acquired a larger transacted sales area than the non-farmer buyers. This descriptive results show that both canton/municipality are net-buyers on average, the number of farmer sellers/ buyer are lower than the number of non-farmer seller/buyer while the total share area of farmer seller/buyer is higher than non-farmer seller/buyer.

Table -2 Statistical description of variables of maker power proxy variables

Variable	Level of description	Unit	Mean	Std. dev.	Min	Max	Expected sign
Market power							
MKP_1	canton	Index-canton	-0.31	0.22	-1	1	+ or -
MKP_1	municipality	indexed-municipal	-0.38	0.3	-1	1	+ or -
MKP_2	canton	Index-canton	0.33	0.15	-0.25	1	+ or -
MKP_2	municipality	indexed-municipal	0.13	0.33	-1	1	+ or -
MKP_3	canton	index-canton	-0.31	0.3	-1	0.4	+ or -
MKP_3	municipality	indexed-municipal	-0.45	0.45	-1	1	+ or -
MKP_4	canton	index-canton	0.03	0.5	-1	0.9	+ or -
MKP_4	municipality	indexed-municipal	0.55	0.44	-1	1	+ or -
MKP_5	canton	index-canton	-0.14	0.35	-1	0.7	
MKP_5	municipality	indexed-municipal	-0.43	0.52	-1	1	+ or -
MKP_6	canton	index-canton	0.38	0.33	-1	0.96	
MKP_6	municipality	indexed-municipal	0.66	0.45	1	1	+ or -

Sources: Own computation based on PERVAL data base.

Discussion on estimation results

We present the discussion based on the estimation results for the bargaining and market power of sellers and buyers on individual farmland prices. As explained in the estimation strategy, theory does not guide the particular functions. Therefore, we opted for first conduct log-linear transformation. We conduct three log-linear price models by the

tenancy status such as (all, tenanted and untenanted) and examine the parameters significance based on the tenancy status of the farmland for sale.

The estimated farmland price model constrained with local farmland market is given in Table-5 under Annex_2. The result of the estimating Box-Cox transformation is gven in Table-3 under Annex_1. The log-linear transformation is better than other common transformation such as log-log, linear or reversal transformations. As we can see the results in Table-5, the overall variables explain the log-farmland price in reasonable way as the model is constrained to local market conditions. As the result, we are forced to use for most of the independent variables are average local characteristics than individual farmland characteristics (With R^2= 0.49 to 0.69 and F=0.00). The multi-collenarility test of Variance Inflation Factor (VIF) each variable also shows below 11. While the heteroscedasticity tests also show that the model fails to reject the null hypothesis of Ramsey RESET test at 5 % level but not at 10% (chi-square values of all estimation were between 8.06% and 9.06%). We therefore report robust standard error results. The coefficient in the equations depends on the postulated process underlying each local market. The implication of those results the role of local market and for the functioning of the local farmland market are now discussed.

The coefficient of determination is satisfactory and their signs on the variables coefficient are as expected reported in Table-4 under Annex-3. The estimations results differ in their representation of the local market and their tenancy type, whether the farmland is tenanted or untenanted farmland. The results of tenancy status of the farmland are the same for agricultural and non-agricultural location characteristics such as urban pressure. The variables coefficients differ and these differences can be used to judge the functioning of the local farmland market. For example, the difference between tenanted and untenanted farmland market is revealed in proxy variables of local farmland market variables.

The marginal values

The marginal values of each variable are computed at the mean price in order to evaluate the effect of each of the variable in the model. Table_6 in Annex-2 reports the marginal effects that are computed at mean values according to the parameter estimation results. The marginal value of official cash rent shows that when the official cash rent increases by one more euro, the price of farmland increases by €18.72/ha for untenanted farmland and €13/ha for tenanted farmlands. Similarly, when the subsidies increase by one euro, the price of farmland will increase by €2.6/ha for untenanted farmlands and by €1.4/ha for tenanted farmlands. In another context, when the livestock density increases by one unit, the price of farmland will increases by €9/ha for untenanted land and €12.32/ha for tenanted farmlands. However, the marginal value of coastal dummy shows that there is difference prices between transaction that takes place under coastal zone and outside the coastal zones. The absolute average price difference between municipalities which are under coastal zone and municipalities which are not under coastal zones is €213.35/ha for untenanted farmland and €119.2/ha for tenanted farmlands. The price difference between male seller and female seller is €137 and €60/ha for untenanted and tenanted markets, respectively. The result has shown us that other remaining personal characteristics such as the gender of the buyers, retired status of the seller and buyer can provide a significant bargaining power neither to seller nor to the buyer.

The computed marginal price of MKP_1 is €154 and €216 for tenanted and untenanted farmlands, respectively. The effect of MKP_1 on untenanted and tenanted farmland price is almost four times higher in canton market model and nearly two times in municipality model. The result indicates that as the number of sellers is greater than the number of buyers, the seller will get higher bargaining power as compared to buyers. This is inconsistent with our expectation. In principle, when the number of sellers higher than the number of buyers, the

sellers should have been competing each other and the price would expect to decrease in favor of the buyers. However, the result indicates that the price increases comparatively against the buyers. This would happen and can be explained by two main ideas. First, sellers are likely to offer more often where a locality is characterized by high sales turnover rate and higher average sales price than in the state of local market that is characterized by low sales turnover rate and lower average prices. Second, we have unobservable problems related to the full picture of the supply sides and demand sides as our analysis is based on actual sales data. We know only the successful sellers and but not unsuccessful sellers and buyers.

The farmers market power on the other hand is explained by farmers' density, number of farmer sellers relative number of non-farmer sellers (MKP_3), farmer seller sales area market share relative to non-farmer seller (MKP_4), the number of farmer buyers relative to the number of non-farmer buyers (MKP_5), and farmer buyer sale area market share relative to non-farmers buyers (MKP_6). The marginal price of MKP_3 shows that, when this index increases by 50%, the farmland price decreases by €295/ha and €149/ha in canton and municipality market model, respectively. On the other hand, when the MKP_4 grows by 50%, the farmland prices will increases by €489/ha and €238/ha for untenanted markets and tenanted farmlands, respectively. Similarly, when the value of MKP_5 increases by 50%, the farmland will increase by €135/ha. On the other hand, if MKP_6 increases by 50%, the price will decrease by €172/ha for untenanted farmland whiles it will increase by €132 for tenanted farmlands.

The overall estimation result shows that the competition of among farmers prevailed both at canton and municipality level. This competition is different according to the tenancy status, the local market model, and the density of farmers' density, the market share of farmer relative to non-farmer. The estimation result also indicates that the local market power

provides a higher bargaining power to the farmer seller than to the farmer buyers and in most of the cases the price tends to increase in favor of farmer sellers than farmer buyers.

Conclusion

The main objective of this paper is to investigate the characteristics of French local farmland market in Bretagne region. Bretagne region is the leading agricultural area in France. The regional farmland similar to any other regions faces intense competition both outside agriculture and within agriculture. We measure the competition of farmland between farmers and non-farmers within agriculture at local level. We introduce the bargaining power and the market power of local markets concepts to explain farmers' competition on farmland prices. The theoretical arguments shows that the final transaction price is influenced by the WTP of buyers and WTA of sellers, number of competing agent , the distribution of offered price of buyers and reservation price of sellers in each local market.

We conduct an empirical description, statistical farmland price variance analysis at canton and municipal level, and farmland price analysis at individual level. We give a description analysis of the location of sellers and buyers from the traded plot. We found the distribution of canton also indicated that 85% of total sales transactions were conducted by buyers who reside with the same canton of the traded plot. Similarly, 76% of sales transactions were purchased by buyers who reside with the same municipality of traded plot.
The individual bargaining power variables are represented by the characteristics of sellers and buyers in our regression model. We found that there is significant sales price difference between farmer buyer and non-farmer seller by €211/ha. The result indicates that when farmers' density of municipality increases by one more farmer, the marginal price of farmland increases by €181/ha and when the number of farmer seller area share increase by 50%, the marginal price of farmland increases by €488/ha. These results indicate that market power of farmer seller is higher than the market power of farmer buyer in local farmland market.

Symmetric significant effect is measured on the demand side. For example, if the traded area share of farmers increases by 50% in the municipality, the price decreases by €172 /ha. The result on the supply side of traded land also reflects the higher willingness to accept (WTA) of farmers and the result on the demand side reflects a pure market power effect, since the farmers' willingness to pay (WTP) is usually higher than non-farmers' WTP.

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Annexes_1

Box-Cox transformation

Box-Cox transformation by design a positive continuous variables (Box and Cox), made popular in economics as a device for letting the data determine what functional form is most appropriate was tested as reference for comparison purposes. The general unrestricted Box-Cox transformation is given as:

$$\Psi^{(\theta)} = \begin{cases} \dfrac{\Psi^{\theta} - 1}{\theta}, \theta \neq 0 \\ 1n\Psi, \theta \longrightarrow 0 \end{cases}$$

Where Ψ is the transformed variable (price variables), and θ is the transformation parameter. Two special cases of the restricted Box-Cox transformation were also considered: the log-linear function, which results from, the application of L'Hopital's rule as the transformations are continuous around $\theta = 0$ and the simple linear function which results when $\theta = 1$. In this study, the equation to be estimated is given

$$P^{(\theta)} = \beta_0 + \sum_{i=1}^{T} \beta_1 z \ + \sum_{m=1}^{m} \beta_1 b_m + \sum_{j=1}^{n} \beta_1 LM + e,$$

The log-likelihood estimation restricted theta test shows that semi-logarithm transformations perform better than linear and the inverse transformations. We prefer to a restricted with known semi-logarithm transformation than the unknown functional distribution. The semi-log functional has statistical super performance as shown in Table-5. Therefore, we can derive the semi-elasticity and the marginal price very easily following this estimation.

Table 3 Values of the log-likelihood functions for functional Box-Cox transformation

	θ=1 (linear function	**θ=0 (log)**	**θ= -1 (inverse)**	**(P=0.05)**	**Ho: θ=1 (linear)**	**Ho :θ=0 (log)**	**Ho: θ= -1(inv)**
Canton							
Tenanted	59.3**	43.94*	132.47***	42.9	rejected	Rejected at the margin	Rejected
untenanted	66.79**	54.27***	148.74***	42.9	rejected	rejected at the margin	Rejected
all	75.81***	45.34*	149.11***	42.9	rejected	reject at the margin	Rejected
Municipality							
tenanted	62.81***	32.58	197.81***	42.9	rejected	can not reject	Rejected
untenanted	64.45***	45.77*	198.3***	42.9	rejected	Reject	Rejected
All	69.06***	44.7**	220.57***	42.9	rejected	can not reject	Rejected

Note: ***, **,* the null hypothesis is rejected below 1%, 5%, and 10%, respectively.

Annex_2: Definition of variables symbols used for regression estimation

Table 4. Detail definition of variables used in estimation

Variable	Variable definition
Dependent variables	
price_ha	the sale price of farmland per hectare (euro/ha).
log_P	logarithm of sales price (euro /ha).
Basic characteristics	
sell_area	the total sale area per transaction.
time_trend	the year trend of farmland price from 1994 to 2007 (indexed as 1, 2, 3...., 17).
Agricultural-characteristics	
off_ rent	The official average cash rental price, aggregated at canton or municipal level (euro/ha).
SGP_ha	Standard gross product (euro/ha).
Sub_ha	average total subsidies (euro /ha).
Awu	the total annual agricultural labor units per canton or municipality (no/canton or municipality).
livest_dens	the total number of livestock unit per 100 hectares of UAA(no/ canton or municipality).
Variable	**Variable definition**
Non-agricultural pressure	
reilly_index	urbanization index (Reilly index=$\sum POP_k/d^2_{i,k}$, where POP_k is total urban municipal or canton population and d^2 is the distance between the sold farmland and urban canton or municipality.
dis_buy	the minimum distance between the municipality locations of traded plot and buyer's municipality (km).
coas_dum	dummy variable. (= 1 If the municipality of traded plot is found under coastal zone, =0 otherwise).
Seller and buyer characteristics	
sell_gend_dum	dummy variable. (= 1 if the seller is male, = 0 otherwise).
buy_gend_dum	dummy variables. (= 1 If the buyer is male = 1 or = 0 otherwise).
sell_ret_dum	dummy variables. (= 1 If the seller is retired = 1 or = 0 otherwise).
buy_ret_dum	dummy variables. (= 1 If the buyer is retired =1 or = 0 otherwise).
Locational variables	
com_land_sell_buy	dummy variable. (= 1 if sellers, buyer and the farmland for sale are found in the same municipality, = 0 otherwise).
com_land_sell	dummy variable (= 1 if only the farmland for sale and seller are found in the same municipality, while buyer is from other area, = 0 otherwise).
com_land_buy	dummy variable (= 1 if only the traded-land and buyer are found in the same municipality, while the seller is found in another municipality, = 0 otherwise).
com_buy_sell	dummy variable (= 1 if the seller and buyer are found in the same municipality, while the farmland for sale is found in another municipality or area, = 0 otherwise).
com_diffe	dummy variable. (= 1 if all three entities, the farmland for sale, the seller and buyer are found in three separate and different municipalities or locations, = 0 otherwise).
can_land_sell_buy	dummy variable (= 1 if the three entities of the market- farmland for sale, the seller and buyer are found in the same canton, 0 otherwise).
can_land_sell	dummy variable (= 1 if only the farmland for sale and seller are found in the same canton but the buyer is coming from other area, 0 otherwise).
can_land_buy	dummy variable (= 1 if only the farmland for sale and buyer are found in the same municipality, while the seller is found in another canton, 0 otherwise).
can_buy_sell	dummy variable (= 1 if the seller and buyer are found in the same canton , while the farmland for sale is found in another canton or area, 0 otherwise)

can_diffe	dummy variable (= 1 if when all three entities (the plot for sale, the seller and buyer) are found in three different locations, 0 otherwise).
Transaction pair dummy	
farmer_farmer	dummy variable (= 1 if the transaction is conducted between farmer seller and a farmer buyer, 0 otherwise).
nfarmer_nfarmer	dummy variable (= 1 if the transaction is conducted between non-farmer seller and a non- farmer buyer, 0 otherwise).
farmer_nfarmer	dummy variable (= 1if the transaction is conducted between farmer seller and a non-farmer buyer or = 0 otherwise).
nfarmer_farmer	dummy variable (= 1 if the transaction is conducted between non-farmer seller and a farmer buyer, 0 otherwise).
Local market characteristics	
farm_dens	it is defined as farmers' density. It refers to the total number of farmers' inhabitant per 100 total utilized agricultural areas (UAA) for each canton's or municipal's farmland.
tran_dens	it is defined the transaction density. It refers to the total number of transaction per 100 UAA of canton or municipality level.
sell_auu	it is defined as sale area density. It represents the total sale area relative to canton's or municipality's total utilized agricultural area (UAA)

Annex_3: Log-linear estimation

Table 5. Log-linear farmland price regression results by tenancy type

a) municipality market model

Tenancy status	All	Untenanted	Tenanted
Variables	**coeff.**	**coeff.**	**coeff.**
sell_area	-0.0001	0.0004	-0.0005
Agricultural income variables			
off_ rent	.0043***	.0049**	.0038***
SGP_ha	.00005***	.000004*	.00005**
Sub_ha	.0005***	.00069***	.0004***
live_dens	.028**	0.024	.036**
Urban-pressure			
reily_index	.00004*	.00006**	-0.000007
dis_buy	.0003**	.0004**	0.0002
coas_dummy	.0455**	.0555***	.0352***
Sellers/Buyers' characteristics			
sell_gend_dum	.0294**	.0359***	.0180***
buy_gend_dum	0.0122	0.0103	0.0068
sell_ret_dum	0.0043	0.0035	0.0062
buy_ret_dum	.0419**	0.0124	.0757***
Locational variables			
com_land_sell_buy	.0350***	.04354***	.0259***
com_land_sell	.0545***	.0595***	.0422***
com_land_buy	-0.0027	0.0117	-0.012
com_buy_sell	0.0235	0.0355	0.0198
Market power			
farm_dens	.0244***	.0168**	.0364***
farmer_farmer	.0483***	.0745***	0.0236
nfarmer_nfarmer	-0.0221	-0.03566	0.0256
nfarmer_farmer	0.0295	.0551**	0.02196
sel_auuper	-0.0001	-0.00014	-0.00004
MKP_1	.0590***	.0405**	.0629**
MKP_2	.0769***	.0757***	.0772**
MKP_3	-0.01848	-.0408**	-0.0017
MKP_4	.0900***	.1228***	.0692***
MKP_5	.0210*	.0355**	0.0078
MKP_6	0.0012	-.0471*	.0388*
time_trend	.004***	.0053***	.0020***
Constant	2.67***	2.579***	2.73***
Number of obs	5916	2766	3160
F	49.17	30.23	23.65
Prob > F	0	0	0
R-squared	0.2341	0.2761	0.2128
Root MSE	0.17099	0.17777	0.16111

Note that: the definitions of variables are given in Table 3 *** Significant at 1% level; ** significant at 5% and * significant at 10%.

b) canton market model

Variables	All coeff.	Untenanted farmland coeff.	Tenanted farmland coeff.
sell_area	-0.0003	0.0011	-0.0007*
Agricultural profitability variables			
off_ rent	0.0063***	0.0149***	0.0335***
SGP_ha	0.00001**	0.00001***	0.0411**
Sub_ha	0.0002*	0.0002	-0.0106
live_dens	0.0327***	0.0557***	0.0246
Urbanization variables			
reily_index	-0.0001***	-0.0003**	0.0174***
dis_buy	0.0003*	0.0010***	0.0093
coas_dummy	0.0184***	0.0287	0.0038
Personal characteristics			
sell_gend_dum	0.0284***	0.0871***	0.0361
buy_gend_dum	0.0072	0.002	-0.0001**
sell_ret_dum	0.0045	0.0095	0.0001
buy_ret_dum	0.0163	-0.0136	0.0116
Location variables			
can_land_sell_buy	0.0448***	0.1109***	0.0062***
can_land_sell	0.0595***	0.1589***	0.00001***
can_land_buy	0.0008	0.0219	0.0001
can_buy_sell	0.0454***	0.1669***	0.0347***
Market power			
farm_dens	0.0410***	0.1097***	0.0044***
farmer_farmer	0.0672***	0.1903***	0.0402***
nfarmer_nfarmer	-0.011	-0.0494	0.0131
nfarmer_farmer	0.0519***	0.1437***	0.0078
sel_auuper	0.0030***	0.0021	0.0112
MKP_1	0.0526***	0.3396***	0.0449*
MKP_2	0.0627	0.1512	0.0781**
MKP_3	-0.0565***	-0.1904**	0.0093
MKP_4	0.0705***	0.6771***	-0.0022
MKP_5	0.0459***	0.0191	0.0507***
MKP _6	-0.002	-0.3163***	0.0677***
time_trend	0.0047***	0.0139***	0.0032***
Constant	2.451***	5.6123***	2.5204***
Number of obs	6004	2801	3203
F-statistics	75.34	42.78	38.06
R-squared	0.5269	0.61242	0.61878

Note that: *** Significant at 1% level; ** significant at 5% and * significant at 10%.

Table-6. The effect of market characteristics on the price of farmland (marginal values)

Variables	Canton			Municipality		
	marginal values (€ /ha)			marginal values (€ /ha)		
	all	untenanted	tenanted	all	untenanted	Tenanted
sell area	-0.94	1.71	-2.4	-0.65	1.46	-1.93
off_ rent	22.08	24.09	113.2	15.28	18.72	12.93
SGP_ha	-0.01	-0.02	139.5	0.02	0.02	0.02
ub_ha	0.64	0.29	-35.1	1.98	2.6	1.4
live_dens	116.71	91.15	82.7	9.91	9.06	12.32
reily_index	-0.38	-0.54	58.4	0.14	0.25	-0.03
dis_buy	1.02	1.68	31.2	1.39	1.8	0.88
coas_dummy	65.14	46.71	12.6	163.85	213.35	119.12
sell_gend_dum	101.43	143.44	122.1	104.94	136.9	60.4
buy_gend_dum	25.42	3.18	-0.3	43.2	13.31	22.89
sell_ret_dum	15.94	15.3	0.4	15.29	46.64	20.88
buy_ret_dum	57.63	-21.94	38.8	150.79	38.92	261.74
can_land_sell_buy	161.07	183.5	20.7	125.62	166.29	87.39
can_land_sell	215.76	265.84	0	197.08	229.07	143.36
can_land_buy	2.84	35.59	0.3	-9.63	44.12	-39.86
can_buy_sell	163.29	279.74	117.3	83.75	135.05	66.81
farm_dens	147.26	181.52	14.5	86.86	63.36	123.5
farmer_farmer	244.58	320.55	136.3	174.21	289.24	79.68
nfarmer_nfarmer	-38.63	-79.02	43.8	-77.16	-130.9	86.39
nfarmer_farmer	187.21	239.61	26.2	105.6	211.85	73.84
sel_auuper	10.51	3.47	37.5	-0.61	-0.55	-0.14
MKP_1	189.75	591.16	152.8	213.98	154.44	216.03
MKP_2	227.46	252.39	270.1	281.1	294.01	267.15
MKP_3	-193.19	-295.17	31.1	-64.42	-149.37	-5.65
MKP_4	256.72	1271.79	-7.4	331.35	488.42	238.49
MKP_5	165.21	30.94	172.9	74.83	135.18	26.35
MKP_6	-6.87	-477.45	232.8	4.27	-172	131.72
time_trend	16.69	22.53	10.6	14.11	20.05	6.93

Source: Own computation