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REGIONAL FOOD PRICE DIFFERENTIALS IN THE PHILIPPINES

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ABSTRACT

Domestic food prices differ by locations and there exist regional differences due to distance, transportation costs, value chain and supply chain inefficiencies. With these issues at hand, this study aims to investigate the regional food price differentials in the Philippines and address what are the possible key drivers that could lead to significant increments in food prices. The study anchored on the price differential model by Gonzalo *et al.* (2012). Results show that significant factors affecting price differences differ per region because of unique issues faced by producers and consumers in different locations.

Keywords: Food prices, law of one price theory, price difference model

INTRODUCTION

Food prices are the average price of particular food commodities globally and across countries. The prices of good are an important indicator not only for the balance between agricultural production and market demand, but also have powerful impacts on food affordability and income. Food prices not only influence consumer affordability, but also influence the income of farmers and producers (Roser & Ritchie, 2019). Prices differ across space: from province to province, and from rural to urban areas. Within one province, systematic differences in prices across a range of goods and services in different localities imply regional differences in the cost of living (Brandt & Holz, 2006).

Market prices move dependently upon the interaction of demand and supply where the balance of demand and supply factors is an equilibrium price. Moreover, there is a tendency for prices to return in its equilibrium unless some characteristics of demand and supply change. This could only happen to either demand or supply, or both, shift or move. Relationship between food prices and demand (own price elasticities) vary according to the type of food and income level of a country. When prices for food rise, the world's poorest household are the ones who are greatly affected. As a result, they are forced to reduce the quality and quantity of food they consumed because food has a large share in their income. This leads to increased food insecurity at the household level (Fyles & Madramootoo). Intra-national PPPs are as important as cross-country PPPs, in view of their requirement in welfare comparisons between household living in different provinces, or between rural and urban areas in a large country. In market perspective, food prices

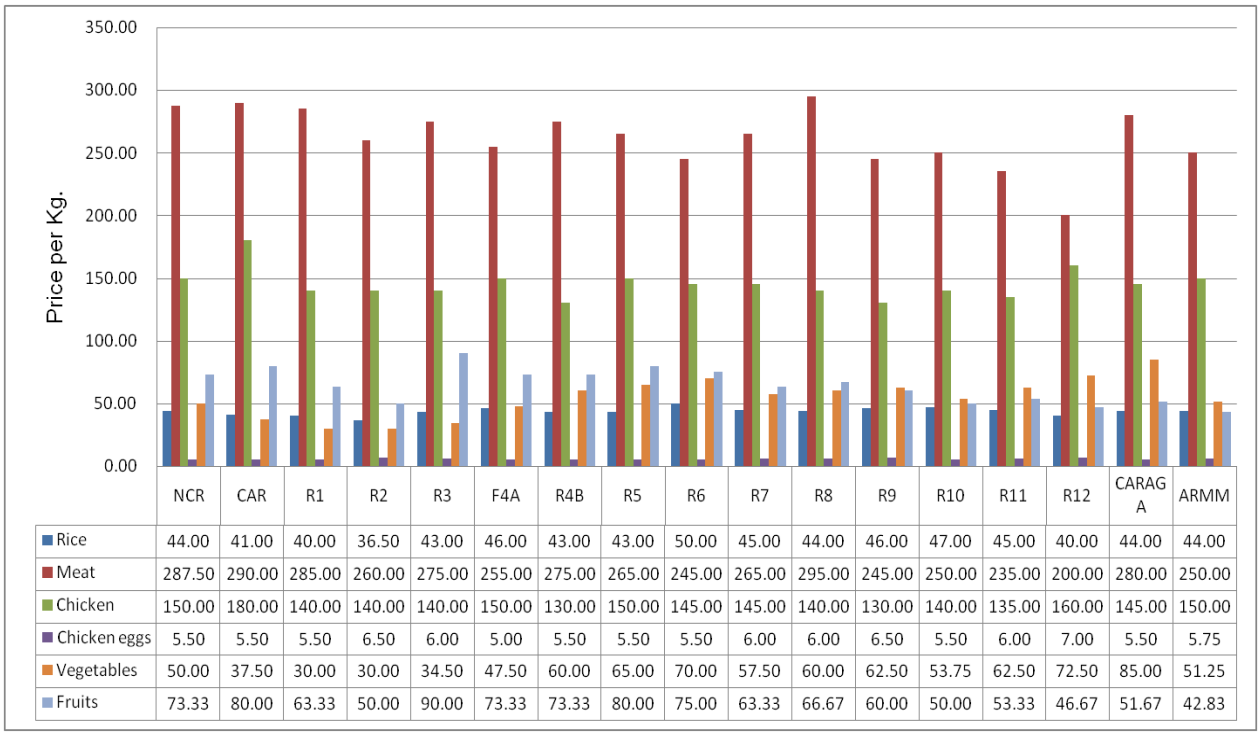
have a direct relationship to agricultural inputs costs like fertilizers, pesticides, fuel for machinery, irrigation, labor, transporting products to the market, and food processing.

With this, agricultural production output is seen as one of the key determinants of food price variation for every country or region. In the Philippines, agriculture increased by 0.07 percent in the second quarter of 2018. Improvements in production were also noted in the livestock and poultry subsectors. However, the crops and fisheries subsector recorded declines in output. At current prices, the total gross earnings of combined crops, livestock, poultry and fisheries subsector amounted to ₱ 447.2 billion. This was 5.55 percent higher than the previous year's record. From January to June 2018, agriculture recorded a 0.58 percent growth in production and farm gate prices went up by an average of 6.39 percent (PSA, 2018).

Philippine agriculture may be set apart among others, by regulated diversification and low productivity. The traditional crops such as rice, corn and coconut account for more than 50 % already of total area harvested and it was only recently that high value crops are given increasing attention. Other ASEAN countries have generally more distinct agriculture than the Philippines and have been exhibiting better agricultural performance. For instance, crop yields are generally lower in the Philippines compared to other countries in the region (Brown, Ebora, & Decena, 2018).

In the Philippines, main staple commodities like rice, meat, dressed chicken, chicken egg, fish, vegetables, and fruits are shown in Figure 1 with their respective prices per region. The commodities presented are measured in prices per kilogram (kg) except for chicken eggs that are measured per piece. It is evident that Region 6 has the highest price for rice at ₱50.00 per kilo, while Region 2 has the lowest price. Moreover, meat is more costly in Region 8 apart from Region 12 where meat is ₱95.00 less. In Cordillera Administrative Region (CAR), chicken meat products are more expensive valued at ₱180.00 and it is ₱50.00 more than Region 4B and Region 9 prices. Majority of the regions has the price of ₱5.50 per piece for chicken egg. However, in Region 12 it is

valued at ₱7.00. Meanwhile, vegetables are also expensive in CARAGA and fruits in Region 3 with prices ₱85.00 and ₱90.00, respectively.



	NCR	CAR	R1	R2	R3	F4A	R4B	R5	R6	R7	R8	R9	R10	R11	R12	CARAGA	ARMM
Rice	44.00	41.00	40.00	36.50	43.00	46.00	43.00	43.00	50.00	45.00	44.00	46.00	47.00	45.00	40.00	44.00	44.00
Meat	287.50	290.00	285.00	260.00	275.00	255.00	275.00	265.00	245.00	265.00	295.00	245.00	250.00	235.00	200.00	280.00	250.00
Chicken	150.00	180.00	140.00	140.00	140.00	150.00	130.00	150.00	145.00	145.00	140.00	130.00	140.00	135.00	160.00	145.00	150.00
Chicken eggs	5.50	5.50	5.50	6.50	6.00	5.00	5.50	5.50	5.50	6.00	6.00	6.50	5.50	6.00	7.00	5.50	5.75
Vegetables	50.00	37.50	30.00	30.00	34.50	47.50	60.00	65.00	70.00	57.50	60.00	62.50	53.75	62.50	72.50	85.00	51.25
Fruits	73.33	80.00	63.33	50.00	90.00	73.33	73.33	80.00	75.00	63.33	66.67	60.00	50.00	53.33	46.67	51.67	42.83

Figure 1. Average Retail Prices of major commodities in different regions in the Philippines as of March 2019. Source: PSA

There are many factors that could lead to significant food price differences within the country, where this marked up input costs that will be carried out to the consumers. Low agricultural productivity, long distance of farm to market, or market to market, associated transportation and transaction costs are at least some of the factors that has direct effect in increasing food prices. Intensifying agricultural production as well as increasing agricultural productivity and resource use efficiency are the principal instruments for reducing poverty, increasing food security and improving rural livelihoods (Pinstrup-Andersen and Pandya-Lorch, 1998).

Trade distortions, inefficient logistics, postharvest losses, and uncompetitive marketing practices, have the cumulative effect of raising food prices, to the grave detriment of poor consumers, while depressing farm incomes. At regional and local levels, inadequate policies, institutions, and rural infrastructure have led to agricultural markets that do not function efficiently. Agriculture plays a predominant role in livelihoods of most people in developing countries. Without access to appropriate markets, small farmers pay more for inputs (seeds, fertilizers, pesticides) and receive less for their produce. In order for this situation to be reversed, trade policies, market access, and availability for credit and insurance must be adjusted at multiple levels.

Rationale

Rising food prices can have a devastating effect on the health of poor households by making it more difficult for them to afford basic food baskets and pose a serious threat to food security at both household and country level. The price increase in cereal, maize meal, bread, sugar, tea, oil, salt, flour and other staples forces the poor to economize on the quantity and quality of their meals. If these foods increase in price, poor households are likely to suffer because most are net buyers of food (Mkhawani, Motadi, Mabapa, Mbhenyane, & Blaauw, 2016).

High prices of major commodities in several regions reflects challenges in agricultural production. According to PSA's Regional Agricultural Production Accounts published in May 2018, crop production of several Regions like CAR, Region 11, Region 4A, Region 7, and Region 12 are below 500 thousand metric tons. Deficit production will lead to a basic action of trading goods in nearby regions. The distribution of food commodities from 2 regions and setting prices are influenced by transportation cost, weather conditions, population of the region concerned, consumer purchasing power and infrastructure constraints. Thus, high prices in major commodities consumed by most Filipinos will lead to a low Purchasing Power Parity (PPP) where fewer baskets of goods will buy if prices are high and could lead to many opportunity costs, increase in food expenditure and less in savings.

For instance, higher rice productivity will increase domestic production and reduce imports of rice and most importantly it will reduce consumer prices. Most of the benefits of improved rice productivity would go to the households in the first decile of the population, since rice has the largest share in their consumption basket relative to the rest of the household groups.

This study is focused on determining the regional food price differentials of a selected sub-category of rice, meat, chicken, vegetables, and fruits. Food prices and agricultural production data of the year 2018 from the Philippine Statistics Authority (PSA) will be used to obtain specific objectives of the study. It is important to conduct this study so that we could determine the external factors that could affect the prices of a commodity in a specific region or country. Price also determines the demand for a commodity which is essential in knowing the cost of living in a particular place.

Objectives of the Study

The general objective of the study is to determine the regional food price differentials in the Philippines, Specifically, it aims:

i. to analyze trends of regional prices and volume of production per sub-commodity in the Philippines;
ii. to compute the regional food price differentials of selected sub-commodities; and
iii. to determine the factors affecting regional food price differentials of selected commodities in the Philippines.

Significance of the Study

It is important to determine the food prices especially in a developing country like the Philippines to know the status of living and the level of welfare in every household per region. This study will also give knowledge on what are the primary drivers that could affect future prices. The results of the study will give knowledge on what are the primary drivers that could affect future prices, it will also give recommendations for the government agencies like the National Food Agency (NFA), Department of Trade and Industry (DTI), Department of Agriculture (DA) and local government by region on what are the necessary actions that should be implemented.

Scope and Limitations

The scope of the study considered 16 regions in the Philippines. National Capital Region (NCR) was taken out from the considered regions to be observed because the region does not have agricultural production where production is one of the independent variables considered by the author. In order to determine the food prices of these regions, the study included 5 major food groups (a) rice, (b) meat, (c) poultry, (d) vegetables, and (e) fruits with their respective sub-categories. Well-milled for rice commodity, lean pork and beef for meat, dressed chicken and chicken eggs for poultry, cabbage, eggplant and tomato for vegetables. Latundan and lakatan banana varieties were considered for fruits.

METHODOLOGY

Theoretical Framework

This study in anchored on the Law of One Price Theory of Persson (2008). This theory states the impact of market arbitrage and trade on the prices of identical commodities that are exchanged in two or more markets. This concept also predicts that same commodity should trade at the same price except for the associated transaction and transportation costs in an efficient and well integrated market. The single price is attained through the exploitation of arbitrage opportunities presented by spatial or temporal commodity price differentials. Fundamental Law of One Price Identity (FLOPI) is used as a tool in measuring the ratio of prices in different regions or countries. Thus, the law of price adjustment for transport and transaction costs implies the following equilibrium.

$$P^{Rx} = P^{Ry} + P^{Tc} \leftrightarrow \frac{P^{Rx}}{P^{Ry} + P^{Tc}} = 1$$

where:

P^{Rx} - is the price of a commodity in Region X
P^{Ry} - is the price of the same commodity in Region Y
P^{Tc}- is the associated transportation and transaction cost for shipping

The theory hypothesized that if the difference between Rx and Ry exceeds the Tc, then the ratio is greater than one which acts as an incentive to rational well-informed traders to take advantage to make profits by moving the commodities from the region with excess to those with relative scarcity. Such arbitrage closes the price gap, because it increases supply and hence, decreases price in deficit region. In addition, while it increases demand, and price in surplus region will have one price (Persson, 2008).

There are several identified factors that directly affect regional food price differentials. One factor is average distance, which represents the transportation costs of commodities, from farm to market, are often high due to long distance from farm to market. Poor road density or infrastructure is also one of the direct factors lead to increase in transportation costs, hence increase in price. Another one is consumer expenditure by region, food expenditure directly increases food prices. Logically, if market sellers know that the food expenditure in a particular region or district is incredibly high, they will transport their product into that region and sell for a greater profit. Furthermore, another factor is regional agriculture productivity, which refers to the level of agricultural production for a certain region and has also a direct impact to food prices. Efficient agriculture output will reduce prices for specific commodity and if the output drops, the prices will increase.

Conceptual Framework

Figure 2 illustrates the direct impact of factors that could affect prices that is domestically traded regardless if they share the same boarder or not. It was stated at the background of the study that average distance, supply condition, and consumption expenditure has direct impact on regional food price differences. Average distance or a higher weighted distance increases transportation costs and therefore increases the price difference. It is a measure of remoteness on price differentials to the extent that reducing the distance reduces the difference. Consumer expenditure also has direct impact on food prices because high incomes will pull demand and price to increase. Lastly, soaring agricultural productivity will even the price across regions; and little production will increase it. Therefore, the output will have negative impact on the dependent variable.

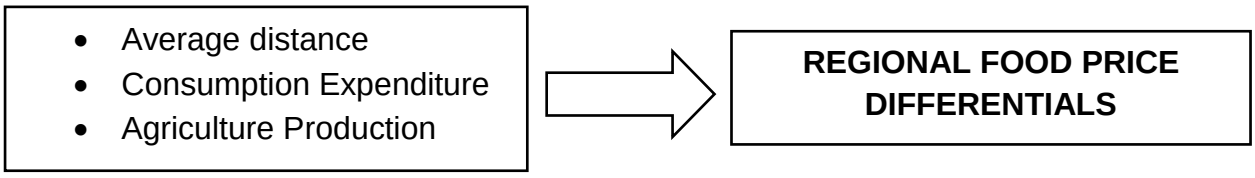


Figure 2. Factors affecting price differentials in different regions.

Variables of the Study

The variables presented in the conceptual framework are discussed with their corresponding definition, and research hypothesis (Table 1). The determinants for

regional food price difference like border of the two regions, the production output of reference and observed regions and the distance between them should have an expected negative sign in the results in order to have connection with the assumed hypothesis between these factors. These hypotheses are (a) if the regions observed shares the same border, the estimates should be negative implying that the closeness between regions lessen the price difference between them; (b) if the production output of these regions are relatively low, there will be an increase in prices and thus, there will be a large difference of prices between the regions with scarce and abundant resources; (c) if the distance between two observed regions in the estimates are negative, this suggests that there will be lesser price difference between regions that has short distances.

Table 1. Explanatory variables, measurement and definition.

Variable	Measurement	Definition
Price Difference	Peso	The difference in price between two products or the difference in prices in different places when the same product is sold in more than one place.
Average Distance	Kilometers (Km)	Geographic separation creates price differentials across regions because of transport costs, even in the absence of institutional differences such as tariffs, taxes, and national borders. If the locations of production and markets are geographically distant, transport costs will be high, and hence there will be large price differentials across regions (Kano, Kano, & Takechi, 2015).
Household Expenditure	thousand pesos ('000)	Consumer spending is another term for voluntary private household consumption, or the exchange of money for goods and services in an economy. Contemporary measures of consumer spending include all private purchases of durable goods, nondurables and services.
Agricultural Production	Metric Tons (mt)	Production is the organized activity of transforming resources into finished products in the form of goods and services; the objective of production is to satisfy the demand for such transformed resources.

Data Source

The study used secondary data from the Philippine Statistics Authority (PSA) from 2017 to 2018. The survey provides data for agriculture production, household expenditure and food prices of the observed commodities in 2018.

Statistical Method

The statistical method is divided into three parts, the trend analysis, computation of price differentials and cross-section estimation.

A. Descriptive Analysis

Descriptive and graphical presentation was used to show the movements of food prices and agricultural production per region.

B. Measuring the food price differentials

In getting the food price difference per region, these steps were followed:

1. A reference region was considered so that the price difference for every sub-commodity are obtained. The study followed the sequence of regions in the Philippines in selecting the reference region. The reference region Wasl automatically swapped by the proceeding region as the next reference region if the price difference of the old reference region and the observed regions are computed.

2. The price of the reference region for one sub-commodity was subtracted and compared to the price of the same sub-commodity of the observed regions in order to get their price difference.

3. There are 10 sub-commodities from the 5 major food groups considered that will use these steps in order to compute the price difference. Moreover, the selection of reference region will stop if the last region from the sequence is the reference region already.

C. Cross-section Data Analysis

To examine the relationship between price differentials and its determinants, Cross-sectional data is a type of data collected by observing many subjects at the same point in time, or without regard to differences in time. Analysis of cross-sectional data usually consists of comparing the differences among the subjects. In economics, cross-sectional studies typically involve the use of cross-sectional regression, in order to sort out the existence and magnitude of causal effects of one or more independent variables upon a dependent variable of interest at a given point in time.

This study used Ordinary Least Squares (OLS) to determine the relationship of identified determinants to price differences per region. OLS method was used to find or estimate the numerical values of the parameters to find a function to a set of data in a linear way. In regression analysis, OLS is a method for linear statistical model by minimizing the sum of the squared residuals (the difference between the predicted and observed value). Estimates of parameters are best linear unbiased estimator (BLUE) if the following assumptions are satisfied:

a.) $E(\varepsilon) = 0$

This implies the mean of the error term is zero

b.) $var(\varepsilon) = \sigma^2$

This is the property of heteroscedasticity, i.e., that the errors have a common variance.

c.) cov (ε_i, ε_j) = 0 where i ≠ j

This is the property of autocorrelation, i.e., no two errors are serially correlated.

To reiterate, the OLS estimator is consistent when the regressors are exogenous and there is no multicollinearity, and optimal in the class of best linear unbiased estimator (BLUE) when the errors are homoscedastic and serially uncorrelated. Under these conditions, the method of OLS provides minimum variance mea-unbiased estimation when the errors have finite variances. Under the additional assumption that the errors be normally distributed, OLS is the maximum likelihood estimator.

Empirical Model

With respect to the process of determining regional food price difference, there is one empirical model for every sub-commodity. The reference and observed region's prices, agricultural output, expenditure and distance for every one sub-commodity will be included in the model. Thus, this empirical model is applied in the study (Shiyekwa and Ijjo, 2016):

$$\left[p_i - p_j \right] = \beta_0 + \beta_1 AD_{ij} + \beta_2 Bo_{ij} + \beta_3 Pr_i + \beta_4 Pr_j + \beta_5 CE_i + \beta_6 CE_j + e_{ij}$$

where:

$[pi - pj]$	= is the price difference of the observed commodity for two compared regions;
β_0	= the constant term (intercept);
$\beta_1, \beta_2, \dots, \beta_6$	= parameters to be estimated;
AD_{ij}	= average distance for two regions observed;
Bo_{ij}	= dummy variable taking the value of 1 if the two regions shares the same border
Pr_i	= level of production for the commodity observed of the reference region measured in metric tons;
Pr_i	= level of production for the same commodity observed of the observed regions measured in metric tons;
CE_i	= consumer expenditure of the reference region for the observed commodity;
CE_j	= consumer expenditure of the observed regions of the same observed commodity;
e_{ij}	= error term.

Results and Discussions

The estimates of the determinants for regional price difference for the 10 sub-commodities considered in the study are presented in Table 1. The consumer expenditure factors have positive expected values which can relate to the price and demand relationship implying that food expenditure for a particular commodity increases, the prices also increases.

In Table 1, it is evident that the coefficients for the production of the reference region Pr_i except for chicken eggs, cabbage and eggplant commodity has an expected negative value, consistent to theory. Though most of the commodities have negative values for Pr_i , it significantly explain t the regional price differences of beef, dressed chicken, tomato, latundan and lakatan banana commodities. Moreover, the production of the observed regions Pr_j is opposite with Pr_i, where it has no negative value. It has only significant values for well-milled, beef meat, dressed chicken, tomato, latundan and lakatan banana commodities. The consumer expenditure of the reference region, Ce_i has only correct value of coefficient for cabbage commodity but it does not significantly affect the price difference while Ce_j or the expenditure of the observed regions has all correct expected positive values except for well-milled Ce_j coefficient. The coefficient for Cej only has a significant value for pork meat, beef meat, tomato, eggplant, and latundan banana. Furthermore, it is noticeable that border and distance for all of the commodities observed are not significant towards explaining the regional price differences. The expected negative value of coefficients for border does not exist only for well-milled, dressed chicken, and cabbage commodity.

Summary, Conclusions and Recommendations

- To expand farm-to-market road projects in the provinces in order to support logistical problems in transporting goods from rural to urban areas.
- This study should be complemented with value chains and supply chain studies of different food commodities.
- Spatial econometric analysis should be used in future studies.
- District, Municipal/City and Provincial level data should be used in order to capture the price differences within provinces and regions.

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Table 3. Estimated Parameters for determinants of regional food price difference for selected sub-commodities.

Variable	Well-milled	Pork	Beef	Chicken	Chicken Eggs	Cabbage	Tomato	Eggplant	Latundan Banana	Lakatan Banana
Border	0.007^{ns} (0.2528)	-0.2348^{ns} (0.2685)	-0.0077^{ns} (0.2799)	0.1721^{ns} (0.2019)	-0.1245^{ns} (0.1549)	0.1394^{ns} (0.2554)	-0.1153^{ns} (0.2228)	-0.0576^{ns} (0.1946)	-0.2666^{ns} (0.1649)	-0.1495^{ns} (0.1677)
Output_i (Pr_i)	-0.0481^{ns} (0.1112)	-0.0537^{ns} (0.1261)	-0.7097*** (0.1115)	-0.3811*** (0.0645)	0.0401^{ns} (0.0525)	-0.2199^{ns} (0.0282)	-0.1251** (0.0619)	0.0393^{ns} (0.076)	-0.5203*** (0.0437)	-0.482*** (0.0444)
Output_j (Pr_j)	0.4539*** (0.134)	0.0059^{ns} (0.1262)	0.6178*** (0.1115)	0.2823*** (0.0645)	0.0142^{ns} (0.0525)	0.0296^{ns} (0.0282)	0.1412** (0.0619)	0.019^{ns} (0.076)	0.4009*** (0.0437)	0.5326*** (0.0444)
Expenditure_i (Ce_i)	-0.2423^{ns} (0.899)	-1.5041^{ns} (1.263)	-3.4532*** (1.076)	-4.9508*** (0.8937)	-0.479^{ns} (0.6666)	1.3573^{ns} (0.9846)	-2.3887** (0.9846)	-1.9175** (0.9159)	-1.4983** (0.6438)	-0.4751^{ns} (0.6547)
Expenditure_j (Ce_j)	-0.4799^{ns} (0.9883)	3.6332*** (1.263)	3.2893*** (1.076)	0.1611^{ns} (0.8937)	0.6488^{ns} (0.6666)	-0.6917^{ns} (0.9846)	4.9423*** (0.9846)	5.4721*** (0.9159)	3.081*** (0.6438)	0.7781^{ns} (0.6547)
Distance	-0.0002^{ns} (0.0002)	0.002^{ns} (0.0002)	0.0001^{ns} (0.0003)	0.0001^{ns} (0.0002)	-0.0001^{ns} (0.0001)	0.0001^{ns} (0.0002)	-0.0001^{ns} (-0.0002)	0.0001^{ns} (0.0002)	0.0002^{ns} (0.0002)	0.0002^{ns} (0.0002)
r2	0.1	0.07	0.28	0.24	0.02	0.02	0.13	0.22	0.6	0.58

Values in Parenthesis are standard errors. *** - Significant at 5 % level. ** - Significant at 10 % level. ^{ns}- Not Significant.