THE EFFECTS OF PRICE AND NON-PRICE FACTORS ON MAIZE SUPPLY ELASTICITIES IN IRAQ

by

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LIST OF ABBREVIATIONS

ECM	Error Correction Coefficient
FAO	Food and Agriculture Organization
FOCs	First Order Conditions
GDP	Gross Domestic Product
OLS	Ordinary Least Square
SOCs	The Second Order Conditions
UNSC	United Nations Security Council
VAR	Vector Autoregressive

LIST OF SYMBOLS

A_{t-1}	Area under maize with one year lag
a_0	Intercept
$a_1.....a_3$	The coefficient of the factors
B_{mt}	Adjustment parameter
DW	Durbin Watson
D_t	Dummy variable
E	Elasticity
F	Function
h	The value of Durbin h statistic
ln	Natural log.
T_t	Technology
t	Time period
TFC	Fixed costs
W	Labour
K	Capital
L	Land
n	Total number of sample
∂P_t	Price risk
P_t	Maize price
P_{t-1}	One year lag price of maize
P_{t-2}	Price lagged two year
P_{t-3}	Price lagged three year

P_{t-4}	Price lagged four year
P_t^*	Expected price in period t
P_{t-1}^*	Expected price in period t-1
P_x	Price of the good
P_{INPUTS}	Prices of the inputs
p	Estimate the first order autocorrelation
S	Represents the number of sellers in the market
$s.e$	standard error
Q	Quantity
Q_t^*	Desired output
Q_{t-1}	Actual output in period t-1
R_t	Average rainfall in mm with one year
R^2	The adjusted coefficient of determination
VIF	Variance Inflation Factor Test
var(α)	The variance of the coefficient of the lagged dependent variable
Y_t	Production of maize in time t
y_{t-1}	Yield of maize with one year lag
Y_t^*	The expected supply
Z_t	Other factors

Kesan Faktor Harga Dan Faktor Bukan Harga Terhadap Keanjalan Penawaran Jagung Di Iraq

ABSTRAK

Jagung adalah salah satu tanaman yang paling penting di Iraq. Jagung adalah sebagai bijirin yang digunakan sebagai makanan utama bagi majoriti penduduk Iraq serta menjadi makanan ternak. Industri jagung telah menyumbang dengan ketara kepada pekerjaan, pembuatan, pertukaran asing dan keselamatan makanan. Kepentingan jagung dalam menyumbang kepada pertumbuhan negara adalah kritikal dan menjadikan ia bermakna untuk menyiasat sifat keputusan pengeluaran petani jagung. Kajian dilakukan bagi mengenalpasti tindak balas penawaran petani jagung ke atas faktor harga dan bukan harga di Iraq menggunakan kaedah ekonometrik. Faktor-faktor bukan harga dipertimbangkan dalam kajian ini adalah penggunaan tanah, teknologi, hujan, pengeluaran tertinggal satu tahun dan pengepungan. Model Nerlovian pelarasan separa diubahsuai telah digunakan dan data yang digunakan ialah data siri masa yang merangkumi dari 1986-2015 untuk menganggarkan tindak balas penawaran jagung di Iraq. Untuk menangani masalah yang dijangka berkaitan dengan data siri masa, kajian mengguna pakai beberapa ujian diagnostik. Keputusan menunjukkan keanjalan bekalan jangka pendek dan bekalan keanjalan jangka panjang adalah tidak berubah yang menandakan bahawa petani jagung adalah kurang sensitif kepada perubahan harga. Keputusan mengesahkan bahawa faktor-faktor harga seolah-olah mempunyai lebih banyak kesan ke atas bekalan jagung di Iraq. Penemuan ini bertepatan dengan apa yang diperolehi dalam kajian tindak balas bekalan untuk tanaman ladang yang dijalankan di negara-negara membangun lain Iraq. Kajian ini juga menunjukkan bahawa faktor-faktor bukan harga seperti hujan, pengeluaran tertinggal satu tahun, teknologi dan penggunaan tanah mempunyai kesan positif ke atas pengeluaran jagung. Memandangkan kajian ini, kajian mencadangkan dasar-dasar yang memberi tumpuan lebih kepada faktor-faktor bukan harga sebagai satu cara untuk menstabilkan pengeluaran jagung. Kajian ini juga mencadangkan bahawa pihak berkepentingan daripad industri dan pembuat dasar perlu mencari cara untuk mengintegrasikan hubungan yang signifikan antara faktor-faktor bukan harga dan output pengeluaran ke keputusan masa depan dan dasar pemasaran untuk melindungi industri jagung yang sihat, berkembang dan mampan di Iraq.

The Effects of Price and Non-Price Factors on Maize Supply Elasticities in Iraq

ABSTRACT

Maize is the one of the most important crops in Iraq, being both the major feed grain for livestock and the primary staple food crop for the majority of the Iraq population. Furthermore, the maize industry contributes substantially to employment, manufacturing, foreign exchange and food security. The importance of maize in contributing to national growth is critical; this makes it meaningful to investigate the nature of maize farmers' production decisions. This study quantifies the supply response of maize farmers to price and non-price factors in Iraq using econometric techniques. The non-price factors considered in this study are land usage, technology, rainfall, production lagged one year and siege. A modified Nerlovian partial adjustment model was applied on historical time series data spanning from 1986-2015 to estimate the supply response of maize in Iraq. To deal with the expected problems associated with time series data the study adopted several diagnostic tests. Results indicate a short-run supply elasticity and a long-run supply elasticity are inelastic, signifying that maize farmers are less sensitive to price changes. The results confirm that price factors seem to have the same effect on maize supply in Iraq. These findings coincide with those obtained in supply response studies for field crops conducted in other developing Iraq countries. The study also showed that non-price factors such as, rainfall, production lagged one year, technology and land usage have a positive impact on maize production. Given the findings, the study recommends policies that focus more on non-price factors as a means of stabilising maize production. The study also recommends that Industry stakeholders and policymakers should find means to integrate the significant relationships between non-price factors and production output into future decisions and marketing policies to safeguard a healthy, growing and sustainable maize industry in Iraq.

CHAPTER 1

INTRODUCTION

1.0 Introduction

The economics of Iraq depends heavily on agriculture which provides the main source of food income and employment especially to the rural population. In Iraq, agriculture plays an important role in the economy as it employs about 60-70% of the population and contributes to about 30% of the Gross Domestic Product (GDP) (Iraqi central Statistical Organization, 2015). Therefore, achieving higher growth in the agricultural sector is of utmost concern especially in the face of rising incomes and increasing population growth. Furthermore, formulating agricultural policies targeted at increasing production is critical to meet this rising demand. However, agricultural growth in the recent past has been declining. It is therefore important to understand farmers' production decisions in order to form policy.

According to Mamingi (1996) agricultural supply mainly in the form of area expansion is determined by agricultural price and non-price factors. Price is very important in determining farmers planting decisions as it provides incentives for them to increase production. Hence in order to meet the rising demand and bring about sustained and balanced economic growth, it is paramount to understand the effect of prices on production supply . Also, non-price factors such as good weather conditions and improving technological and institutional frame leads to shifts in the supply function. This is particularly so, for developing countries where various studies (Patel & Singh, 1994, Dixit, et al., 1998) have shown that farmers response behaviour are

influenced more by non-price factors. Among the staples grown in Iraq, maize has been identified as one of the most important within the grains and cereals family. It is cultivated on more than, 378,061 hectares and across all agro ecological regions in Iraq (central Statistical organization, 2015).

Maize crop is considered as one of the most widely grown crops around the globe since it is consumed by human beings both in direct and indirect ways (Dhla, 2008). Additionally, corn flour extracted from maize seeds can be included within the essential wheat flour at a percentage of 5-15% to be used for human nutrition. This corn flour is extracted from maize seeds, the latter has a carbohydrates percentage of 70-80%. Same seeds can be used to produce vegetable oil since they contain 4% of liquid oil that is credited for its nutritious and pro-health features, not to miss upon its suitability as a green and/or dried livestock feed (Ali, 2008). As for the cobs of maize, they contribute to the making of pulp for paper production (Al Obeidi, 2013).

The global importance of maize is clearly manifested through the global trend of generating renewable energy through the use of maize to manufacture biofuel (namely; ethanol) knowing that the high rates of this crop are what is actually standing against its desired application. Speaking only of the year 2006, the prices of maize rocketed to unprecedented rates as the ethanol distillation facilities devoured fifth of the US maize total production (Ali, 2008).

As for Iraq, maize is regarded as one of few major economical crops of the country , rating fourth next to wheat, barley and rice. The acreage exploited for growing this crop fluctuates up and down from one year to the next. In 2013, a total of 798,099 acres were exploited, producing around 831,299 tons of maize crop, but this figure soon dropped down in 2014 to 378,061 acres while the production size jumped

to 289,288 tons (FAO,2014). Out of all Iraqi provinces, Babylon comes first as per the acreage used for growing corn crop (Mahdi, 2010).

The importance of producing maize on a national level comes from the fact that the acreage and costs of producing this crop are both directly affected by any changes in global prices, which can negatively affect the imported quantities of maize. On an international level, the Asian acreage of maize agriculture is very little since its inhabitants consume the majority of what they produce, as well as corn being the major nutrient ingredient for people in developing countries of the three continents (Asia, Africa and Latin America), while in developed countries maize is used in manufacturing livestock feed and vegetable oils as well as other industries too.

The United States and the China claim the first and second positions respectively of a list of the major corn producing countries, with the USA producing 37.20 % of the total global production, and China producing 21.12% of the total production during the first years of the first decade of the ongoing century (USDA, 2016).

The Far East of Asia monopolizes the vast majority of maize production, being responsible for 21% of the global maize production. On the other hand, USA claims the first position in the whole world with a contribution of 45% of the total global production of maize crop, Asia coming second with a percentage of 27% of the global maize production. European Union comes third with a percentage of 12% of the global maize production, while South America which caters for the fourth global position lends itself to Brazil that provides 76.5% of the continent's output of this crop.

Even though maize is one of the most essential crops for Africa, this continent's production is limited to no more than 7% of the average global production of maize. The final position is claimed by Australia, producing only 1% of the global production

of maize (Alkholany, 2005). Maize crop production in Iraq during the study period averaged to 349,053.68 tons. There was a slight increase during 1986-2015 about 4.6% due to expanding measures because of technological advances such as the adoption of new varieties, greater application of fertilizers and irrigation. Maximum production was in 2013 reaching 831,299 tons Soon, however, the level of production declined during 2014 to reach 289,288 tons (Alobaidi, 2013).

As for the global prices of this crop in light of the Asian financial crisis, the global prices of maize scored consecutively low figures through the years from 1997-1999. This was due to the decreased import rates of maize by the crisis countries, which contributed much to lowering its prices. However, those prices resumed escalating once again due to epidemic draught seasons in maize producing countries like USA, China, India and Romania during the years 2001 and 2002. The prices scored surges from USD 88.22 in 2000 up to USD 89.61 in 2001 and USD 99.33 in 2002 (Alkholany, 2005). In Iraq, the prices of the crop under study was fluctuating each and every other year (Alobaidi, 2013).

1.1 Background of the Study

Getting well-acknowledged of all aspects and facets of any economical phenomena or problem is a crucial provision for a proper perception and treatment, be those aspects direct or indirect, positive or negative. Therefore, this study is mandated to include the meanings and concepts of both supply function and supply response for relevance issues.

Supply represents the counterpart and complimentary of demand as for determining the prices of goods in the market. Supply represents is a form of

a relationship correlating the quantities of goods that the producers can provide and the various parallel prices. This relationship is about a trading, partial and marginal nature. As for the trading side of this relationship. This is because supply relates to the policies of producers in the production trading phase. This relationship is partial too since supply relates two basic parameters to each other: the quantities produced and supplied to the market on one side, and the prices on another. As for the third description, this is because supply is linked to the producer's behavior. A producer views the goods price as a marginal income in case of total free competition. A producer then equates the marginal income to the marginal cost to decide upon the best quantity to produce (Al Wardi, 2008).

Being an economical activity, agricultural production is governed by laws and general economic concepts each of which having its own limitations and restraints. Due to the inherent factors related to the agricultural production such as risk and uncertainty which are influenced by the environmental and biological circumstances such as temperature, humidity, rainfall and catastrophes, the agricultural production has been the main focus of many researchers who all agreed that supply function differs from supply response function. This is because unlike supply response function, the supply function presumes a fixed technological level for the production (Al Wardi, 2008).

Additionally, supply response function is affected by other factors other than the product's price, such as prices of production resources, water and the rivaling crops prices. In other words; the supply function is a reflection of only the product's price while the supply response curve is influenced by other factors as mentioned before, not a reflection of only the price of the product. Based on what has been mentioned here, it is clear that the prices of production resources comes ahead of all other factors influencing both supply and supply response functions (the latter representing how

much of production quantity through which the producers respond to price changes) objectives (Al Obaidi, 2010).

By adding prices into the production function, it will turn it into a supply function. Since the prices are directly proportional to supply quantities, the supply elasticity is usually positive and it depends on how easy or difficult is the transportation of production elements. The more the substitution in production elements is facilitated, the more elastic is the supply. Alternately, if the production resources were not invested in a production activity, nor were they transferred to another production field, the supply is deemed less elastic (Al Dahiri, 1990).

It is worth mentioning here that the economic theory presumes that the producer be articulated with how to use the resources available to him in order to achieve the objectives (Al Obaidi, 2009). In light of such experience and in response to the various economic changes, it is to keep the production level at the lowest cost for the profit or revenues.

Most modern studies on supply response of field crops place great emphasis on the necessity of dismantling total production down to its elements; i.e. the cultivated acreage and the productivity of unit area. Houck & Gallagher (1976) offered reasons for this emphasis based on an assumption: that producers plan their production decisions. Based on this assumption in analyzing the supply function, it is possible to deduce an equation for the acreage supply, using the production function as it is a function for various factors and production resources contributing to the production process (Alobaidi, 2009).

Nnumerous studies have been focused on agricultural supply, which response to price and non-price factors with wide range of crops over the years. More importantly, expanding cultivated area is a viable option for increasing production

(Molua, 2010). Understanding how producers make decisions to allot acreage among crops and how decisions about land use are affected by changes in prices and their volatility is fundamental for predicting the supply of staple crops and, hence, assessing the global food supply situation (Haile, Kalkuhl, & Von Braun, 2013).

The production decisions of farmers are dependent on various policies of the government. Price policy, among the others, is the most important one. That is, farmers would allocate their limited land resources to that crop enterprise towards which the relative price movements tend to be favourable. This is however, quite logical and rational as the allocation of land to a better-priced crop would fetch more revenue to farmers. Responsiveness of farmer's to economic incentives such as price could influence contribution of agriculture to economy (Mushtaq & Dawson, 2002).

One of the most important issues in agricultural economics is supply response. Since the responsiveness of farmers to economic incentives largely determines agriculture's contribution to the economy. The gap between planting and harvest guarantees that agricultural producers do not know in advance what price they will receive for their product and the random nature of production ensures that producers do not know in advance what their output (yield) will be. The knowledge on the extent to which agricultural sector responds is not only important in understanding the dynamics of production, but also for planning public programmes, mindful of the producer behaviour and response to prices (McKay, Morrissey, & Vaillant, 1999).

The crucial factors responsible for farmers' production allocation behaviour are expected price (based on previous years price), price of competing crop, yield, weather climatic conditions, area, technology etc. The pioneering work of Nerlove (Nerlove, 1958) on supply response enables one to determine short run and long run elasticities; also it gives the flexibility to introduce non- price shift variables along with

price. Very little analytic research as per the knowledge of this researcher has been carried out on maize production in Iraq (Mushtaq & Dawson, 2002; Nosheen & Iqbal, 2008). Production response to price and non-price incentives is of considerable importance for devising suitable policy and planning development programmes for the agricultural sector of an economy.

The total supply response is the response of the total output to price and non-price factors (Rao, 2003). The concept of supply response in economic theory usually refers to output production in response to their prices and supply curves that are anticipated. Over the past years there has been a number of empirical studies on supply response and economic rationale of farmers in developed and developing agricultural economies such as by Leaver (2004), Rao (2003), Kalirajan, Mythili, and Sankar (2001), Muchapondwa (2009), Baker (2010), Mahmood (2010) and Gwara (2011). However, the nature and extent to which farmers respond to changes in price and non-price factors still remains a debatable issue.

Moreover, reliable estimates of production response of maize growers are of greater importance for predicting accurately the farmers' responsiveness towards the price and non-price factors and for formulating programmes consistent with national requirement of food and fodder. There has been some similar work which also has aimed at analysing supply response of farmers such as by Nkang, Ndifon, and Edet (2007), Baker (2010), Al Obeidi (2013), Tchereni (2013), Riaz, Ali, and Jan (2014) and Shoko (2014) who state that the response of production to price and non-price incentives.

1.2 Overview of Collected Data

Multiple resources contributed to providing access for databases pertaining to prices, acreage, production and productivity from the Ministry of Agricultural of Iraq (2015). The total annual rainfall from the Ministry of environment of Iraq from 1986-2015. Table 1.1 shows the data.