

T.R.
GEBZE TECHNICAL UNIVERSITY
INSTITUTE OF SOCIAL SCIENCES

**EID AL-ADHA: A NATURAL EXPERIMENT FOR COMPETITIVE
PRICE ADJUSTMENT**

Ali Fehim CEBECİ
A THESIS SUBMITTED FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
DEPARTMENT OF ECONOMICS

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DOKTORA JÜRİ ONAY FORMU

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ÖZET

Bu çalışma, Kurban Bayramı döneminde koyunlara yönelik ortaya çıkan devasa talep şoku hadisesini kullanarak, bu özgün doğal deney yoluyla, bir talep şoku durumunda fiyatların nasıl hareket ettiğini incelemektedir. Talep şoku ve fiyat hareketine yönelik literatürdeki mevcut çalışmalar, perakende mallarının fiyat hareketini incelemekte ve teorinin öngörüsünden farklı olarak talep şoku durumunda fiyatların yükselmekten ziyade düştüğünü göstermektedir. Bu durum literatürde, perakendecilerin fiyatlama stratejileriyle açıklanmaktadır. Kurban Bayramı döneminde ortaya çıkan talep şoku ise kimi kritik ayrıştırıcı özellikleri sebebiyle talep şoku ve fiyat intibakı ilişkisini perakende fiyatlama stratejisini dışarıda tutan bir yapıda incelemeye imkan tanımaktadır. Görünüşte ilişkisiz regresyon (seemingly unrelated regression, SUR) modeli yoluyla elde edilen sonuçlar koyun fiyatlarının teoriyle uyumlu hareket ettiğini: Kurban Bayramı dönemi ve bir ay öncesinde fiyatların artma eğiliminde olduğunu ve takip eden üç ayda da düşme eğiliminde olduğunu dayanıklı bir şekilde göstermiştir. Koyun fiyatları bayramdan bir önceki ay 1.2% ile 1.3% daha yüksek Kurban Bayramı ayında ise 1.4% ile 1.5% daha yüksek olma eğilimindedir.

Anahtar Kelimeler: Talep Şoku, Fiyat İntibakı, Tam Rekabet Dengesi

SUMMARY

This study examines the price response to an excess demand shock through a unique natural experiment: the demand shock to sheep prior to the Islamic festival of sacrifice. The literature on excess demand shocks and price response mainly focuses on the behavior of retail prices during periods of high demand, and empirical studies have shown that retail prices tend to fall during the peak demand periods. The demand shock arising prior to Eid al-Adha has distinguishing features that enable empirical examination of price responses apart from a retail pricing setting. Seemingly Unrelated Regression (SUR) model results of the study have robustly shown that prices behave in accordance with the theory: sheep price tend rise from prior month of the Eid and the Eid month then prices constantly fall for the three consecutive months of the Eid month. Sheep price tends to be between 1.2% and 1.3% higher a month before the Eid month and between 1.4% and 1.5% higher during the Eid month.

Keywords: Excess Demand, Price Adjustment, Competitive Equilibrium

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LIST OF SYMBOLS AND ABBREVIATIONS

<u>Symbols and</u> <u>Abbreviations</u>	<u>Description</u>
ε	: Error Term
β_i	: Coefficients
TUIK	: Statistical Institute of Turkey
TIGEM	: General Directorate of Agricultural Enterprises of Turkey
FAO	: Food and Agriculture Organization
GDP	: Gross Domestic Product
TL	: Turkish Lira
USD	: United States Dollar
CPI	: Consumer Price Index
OLS	: Ordinary Least Squares
SME	: Small and Medium Sized Enterprises

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1. INTRODUCTION

Walrasian proposition that the prices are driven by the excess demand is one of the dominant price adjustment mechanisms in economics literature. If demand for a commodity is higher than the supply of that commodity, i.e. excess demand is positive, then price of the commodity rises and vice versa. The prices are adjusted in line with the sign of the excess demand until the market clearing level of prices are achieved through Walrasian *tâtonnement* process.

Empirical studies regarding the excess demand shocks and response of the prices mainly utilize dataset on prices of items sold in retail stores and focus on behavior of retail prices during the periods of high demand such as; weekends, pre-Christmas holiday periods, post-Thanksgiving weekends and Easter shopping periods. Therefore, relevant literature is broadly concentrated on retail firms' pricing strategies (Chevalier et al., 2003; MacDonald, 2000; Warner & Barsky, 1995). Empirical studies justified that the response of retail prices to an excess demand shock is in stark contrast with what the theory predicts; retail prices tend to fall during the peak demand, positive excess demand, periods.

This study aims to contribute the literature on response of prices to an excess demand shock through a unique natural experiment: the demand shock to sheep prior to the Muslim sacrifice feast (Eid-al Adha). Sheep are not retail goods, they don't take place in the usual consumption bundle of consumers, they are brand-free, almost homogeneous, commodities. Thereby, Eid-al Adha period provide a natural experiment for response of prices to an excess demand shock free from retailer pricing strategies and oligopolistic competition among brands and firms. Moreover, in Turkey, trade of sacrificial animals is obliged to take place within the sacrificial animal markets which are established solely for these transactions prior to each Eid-al Adha period by municipalities of provinces and districts. Breeders can hire places in these markets 15 days before the start of the Eid. People, willing to fulfill worship of sacrifice, purchase their sacrificial animal in these markets by bargaining with breeders. Customarily, breeders don't mark price tags on their animals; buyers offer a price and if the breeder

take the offer as negotiable a person around them take part as a negotiator; hold and shake their hands until both parties are persuaded to agree on a price. Therefore, this period is also free from rigidities on price adjustment due to rising opportunity cost of labor time during high demand periods for retailers as argued by Levy et al. (2010). Further, the confusion suggested by Chevalier et al. (2003) that whether the source of price movement during high demand periods is due to retail pricing or wholesaler pricing does not exist during this period since the sellers on the market are actual breeders of the animals. Such distinguishing features of demand shock arising prior to Eid-al Adha enable us to empirically examine response of prices apart from a retailer pricing setting.

Our results robustly show that sheep price tend rise from prior month of the Eid month and the Eid month then prices constantly fall for the three consecutive months of the Eid month. Sheep price tends to be between 1.2% and 1.3% higher a month before the Eid month and between 1.4% and 1.5% higher during the Eid month.

2. LITRATURE REVIEW

2.1. Walrasian Price Adjustment Mechanism

The Walrasian proposition that prices are driven by excess demand is one of the dominant price adjustment mechanisms in the economics literature. If demand for a commodity is higher than the supply of that commodity (i.e. excess demand is positive), then the price of the commodity rises, and vice versa. The prices are adjusted in line with the sign of the excess demand through the Walrasian *tâtonnement* process until the excess demand vanishes, and the market clearing level is achieved (Anderson & Stanford, 1993; Asparouhova et al., 2003; Gintis, 2007).

In its stylized version; an auctioneer collects agents' demand and supply. In case of a demand imbalance auctioneer adjust prices and agents instantly update their demand and supply. This mechanical process goes on until the agents' demand equal the supply (Asparouhova et al., 2003).

The so-called Walrasian *tâtonnement* process enable to overcome problem of full knowledge on supply and demand curves (Donier & Bouchaud, 2016). Defining amount of demand by $D(p, t)$ and amount of supply by $S(p, t)$, (where p denote price and t denote time); Walrasian demand adjustment states that price is determined by excess demand function: $E(p, t) = \gamma(D(p, t) - S(p, t))$ and equilibrium is achieved via *tâtonnement* process at a price p^* such that $E(p^*, t) = \gamma(D(p^*, t) - S(p^*, t)) = 0$ (McCallum, 1974; Raberto et al., 2006).

Empirical studies regarding the excess demand shocks and response of the prices mainly utilize dataset on prices of items sold in retail stores and focus on behavior of retail prices during the periods of high demand such as; weekends, pre-Christmas holiday periods, post-Thanksgiving weekends and Easter shopping periods. Therefore, relevant literature is broadly concentrated on retail firms' pricing strategies (Chevalier et al., 2003; MacDonald, 2000; Warner & Barsky, 1995).

Warner and Barsky (1995), using daily survey data on retail prices of eight items, provided evidence that the prices of these items have a tendency to fall as high demand period, weekend, approaches. MacDonald (2000) analyzed prices of food products, which are subject to demand hikes in a seasonal pattern and using scanner data showed a statistically significant fall of prices during the demand hikes for 44 products out of 48 products under consideration. Chevalier et al. (2003) employed a unique dataset of store level scanner data from a large supermarket chain including not only retail prices of items but also quantity sold and prices paid by the supermarket to the supplier. Their analysis provided additional support for the countercyclical behavior of retail prices over the seasonal demand cycle which is valid for idiosyncratic demand shocks as well as overall demand shocks for the stores.

In sum, empirical studies justified that the response of retail prices to an excess demand shock is in stark contrast with what the theory predicts; retail prices tend to fall during the peak demand, positive excess demand, periods.

Warner and Barsky (1995) attribute this contradiction to the possible surge of price elasticity of consumers since they are more informed on market conditions through increasing number of advertisements during high demand periods which force retailers to cut prices. MacDonald (2000) showed that the price declines are unrelated with cost conditions instead they are the outcome of oligopolistic competition among retailer firms. Loss-leader model of pricing strategy is another explanation for counter cyclical behavior of retail prices in which retailers offer discount on high demand products with the anticipation that the customers choose the store based on highest discount offered on certain products (Chevalier et al., 2003). DeGraba (2006) argues that loss-leader pricing aims not only to attract higher quantity of customers it also aims to attract more profitable customers. Guler et al. (2014) claimed that the variation

in the valuation of the products between the off-season and in-season periods by consumers, incline retailers to implement countercyclical pricing as an optimal strategy. They empirically confirmed the claim.

Remaining studies can be broadly categorized into empirical studies based on rare financial events, experimental studies and theoretical studies of Walrasian *tâtonnement* mechanism. McCallum (1974) used data from U.S. lumber manufacturing sector to examine empirically examine supply and demand dynamics within a Walrasian framework and showed that coefficients suggested by an inventory included model more consistent than inventory free model. In their theoretical study Herings et al. (1998) showed that in the long run, with a considerable amount of adjustment interval, equilibrium level suggested by Walrasian *tâtonnement* process achievable. Filer and Hanousek (2001) employing a rapid and huge financial trade process as a natural experiment examined market price as an efficient signal to agents and prices' adjustment dynamics in attaining equilibrium. Asparouhova et al. (2003) investigate correlation between excess demand and price adjustment employing 11,000 experiments from financial markets and concluded with significant support for the excess demand as a major dynamic for price adjustment. In an experimental study Gintis (2007) showed that a theoretical Walrasian economy with multi sectors (consumers, firms and labors) is capable of achieving market clearing level and secure Pareto efficiency. Eaves et al. (2008) by employing futures contract auctions in Tokyo Grain Exchange empirically investigated whether the nature of an actual auction coincide with Walrasian claim that information of a declared future price itself contain sufficient information for agents to achieve market clearing level. Asparouhova and Bossaerts (2009) proposed an alternative experimental model in which price of a security is not only related by its own excess demand but also excess demand of other securities as well. Donato et al. (2011) showed the theoretical equilibrium condition of a Walrasian excess demand function when prices not only depend to existing excess demand in the market but also depend on previous conditions of the market, i.e. prices are time dependent. Donier and Bouchaud (2016) showed empirically that in case of an excess demand when transactions are allowed to happen continuously demand and supply vanish quadratically to attain Walrasian equilibrium.

Le Bihan et al. (2007) evaluated more than 10 million price records which are used for the French consumer price calculation and their results showed prices are both time and state dependent. Hosken and Reiffen (2007) propose a price discrimination model for the multiproduct retailers and argue that price discrimination for one product will have repercussions for the prices of the other products in the consumption bundle of the consumer. Scholten et al. (2009) argued that “weekend effect” of the prices on the offline stores which are linked to search and transportation costs of the customers would be disappeared for the online stores where these costs do not exist but results showed few significant day of the week price variation. Cornia et al. (2012) empirically justified that prices in the airline industry behave procyclical with the business cycles. Empen and Hamilton (2015) investigated brand level price adjustment of the retailers’ for the beers during Bundesliga game weeks and concluded that retailers tend to reduce home team sponsored beer brand prices while they rise the price of visiting team sponsored beer brands. Campbell and Eden (2014) examined weekly US scanner data to assess rigidity of the retail prices and revealed that retail prices go through the path of nominal adjustment when a store’s price significantly deviate from the average price of the remaining retailers. Birg and Goeddeke (2016) in their review of pricing strategies of the retailers during the Christmas period showed that food prices tend to behave countercyclical during the Christmas peak demand period while stock prices for the retailers rise. Miao (2016) argue that retailers lean into price cuts to take the advantage by luring the consumers during these periods and by holding off-season prices high. Volpe et al. (2017) extend the literature on price adjustment by investigating the determinants of retail prices during peak demand periods and conclude that motivation to rise prices differ from that of decrease prices and main determinant is the category-level demand. Etienne and David (2020) in their empirical study argue that while demand of the consumers show high degree of cyclical pattern retailer price responses are limited in response to these cycles.

2.2. Sustainability

Total global demand for grain is expected to be twice higher and world population is expected to be 1.5 times than today by 2050 revealing that higher food

output will be essential in order to feed world population. Livestock meat consumption is also in a rapid rise during the last four decades. Industrial food production while more efficient and preferable by farmers in their challenge for competitive production it has negative externalities. One of the significant externality is loss of genetic diversity due to preference by farmers and producers more productive breeds (Tilman et al., 1996).

The concept of sustainability concerns more with survival of future generations, i.e. allocation of resources in a way that prosperity of future generations is guaranteed, rather than survival of current generation on earth. Economic growth brings about higher income for people but at a cost of environmental hazard. Recently, such environmental hazard far exceeded the population growth implying that economic growth with its current phase is unsustainable.

2.2.1. Concept of Sustainability

Daily and Ehrlich (1992) estimate population size that would be supporting future generations without undermining world's resources and forecast future dimensions of depletion of Earth's carrying capacity. Costanza and Patten (1995) aims to assess what is to be sustained and how long to be sustained within the definition of sustainability. Maclaren (1996) analyze the process of urban sustainability reporting and its restructuring necessity in which all parties (local government, individuals, businesses) are informed regarding their actions' effect on urban sustainability. Anand and Sen (2000) discuss economic sustainability by interrogating definition of the property that is to be sustained within the intergenerational framework of economic sustainability. Valentin and Spangenberg (2000) gives an overview of sustainability definition and indicators for sustainability as defined by Brundtland Commission. Phillis and Andriantiatsaholainaina (2001) empirically examine countries sustainability levels using fuzzy logic to give a scientifically proven definition of sustainability. Cash et al. (2003) investigate the role of science and technology in sustainably providing needs of humans and suggest that the science and technology can only be successful in achieving this outcome when they produce knowledge transferrable to parties responsible for action. Clark and Dickson (2003) define scope

of the sustainability as a science; the systematic relationship between nature and society; how do the changes in social behavior shape nature and changes in nature shape society. Sikdar (2003) gives an overview of different aspects of sustainability, metrics to assess sustainability and propose a metric to assess sustainability. Turner et al. (2003) propose stages of vulnerability analysis of sustainability. Three stages of the analysis are: exposure, sensitivity and resilience each of which require considerable attention.

Johnson et al. (2004) propose a planning model for achieving sustainable innovations including a five step process. Pope et al. (2004) offer an alternative definition of sustainability assessment by comparing triple bottom line approaches and principles-based approaches. Swart et al. (2004) propose foundations of renewed sustainability science and evaluate its challenges and complex interactions. Hadorn et al. (2006) assess the association between the concept of transdisciplinarity and sustainability. Vlek and Steg (2007) give an overview of environmental depletion and resource use and examine the sustainability of human nature interactions. Seghezzo (2009) offer a framework for sustainability consist of five measures under the three categories. Tanguay et al. (2010) examine sustainable development indicators using 17 empirical studies and show the lack consensus among researchers regarding the methodology and indicators to include in calculation of sustainable development indicators. In their literature review Wiek et al. (2011) evaluate the academic practices for sustainability courses with respect to course design, learning outcomes and scholars. Arrow et al. (2012) propose a novel theoretical model to address sustainability of welfare using welfare as an indicator rather than income. Dahl (2012) argue that available indicators of sustainability are successful at determining unsustainable trends, but they are not capable of producing sustainable trends and evaluate these indicators in detail. Lawhon and Murphy (2012) describe socio-technical transition theory from the sustainability point of view with a special emphasis on geographers. Leach et al. (2012) argue that achieving sustainable development goals require transformation of innovation methodology and a new definition to what we regard as technological development. Markard et al. (2012) analyzed 540 journal articles to identify the emerging field of sustainability transitions and show that this

field combine interdisciplinary studies from economics to sociology to management studies.

Moldan et al. (2012) discuss the term environmental sustainability and evaluate indicators and targets that are utilized to assess environmental sustainability. Brandt et al. (2013) investigate transdisciplinary studies in sustainability research by qualitatively and quantitatively examining peer-reviewed studies in the field. Hahn and Kuhnen (2013) provide an extensive review by examining 178 articles for two decades period in the field of sustainability reporting. Olsson et al. (2014) explored the relationship between the concept of resilience and sustainability scholarship by focusing three distinctive research areas that are both sustainability and resilience concepts may focus and interact. Liu et al. (2015) discuss system integration, integration of human and nature systems, which is crucial for maintaining global sustainability, food security and clean water systems. Fischer et al. (2015) discuss priorities for the social and ecological system to achieve better understanding and practices for sustainability. Ghisellini et al. (2016) review the literature on circular economy phenomenon; its history, origins, strong sides, weaknesses and its implications for all levels of the economy.

2.2.2. Agricultural Sustainability

Hansen (1996) question the adequacy of sustainability concept in guiding and overcoming future challenges of agriculture. Doran and Zeiss (2000) argue that managing soil biotic components efficiently is critical in sustainable soil use and a sustainable soil management approach should take this parameter into consideration as a crucial determinant. Rigby and Caceres (2001) discuss the sustainability of agriculture with regard to outcomes produced by organic farming. Wilson and Tisdell (2001) discuss paradox of increased use of pesticides while use of pesticides has negative externalities diminishing the sustainability of farming. Doran (2002) asses the importance of soil quality in sustainable production and gives examples of sustainable soil use and land management practices. Uzzell et al. (2002) analyzing survey results with structural equation model show that identity is the most crucial determinant in terms of neighborhood sustainability. Pahl-Wostl (2002) evaluate water

management systems in terms of sustainability and propose a theoretical model assessing sustainability outcomes of institutional structures and technological policies. Pacini et al. (2003) aims to assess sustainability outcomes of different farming systems (organic farming systems, integrated farming systems and conventional farming systems) by applying a controlled experiment in Tuscany, Italy. Giovannucci and Ponte (2005) examine efficiency of standards introduced in the coffee industry as a new phase to achieve sustainability and trade fairness. Montgomery (2007) show that erosion rates are so high that might pose a threat for agricultural sustainability in the long run and suggest no-till practices of agriculture as a sustainable alternative.

Reynolds et al. (2007) review problems that the global drylands face and offer a new framework (the Drylands Development Paradigm) concerning tackling these problems in a sustainable manner. Muga and Mihelcic (2008) use economic, societal and environmental indicators to assess sustainability of wastewater management schemes. Pretty (2008) evaluate agricultural sustainability concept in a broad way with its implications for food productivity and carbon emissions. Godfray et al. (2010) delve into the crucial subject of sustainable food security and explore aspects of global strategy offered within the study. Nardone et al. (2010) evaluate future challenges of livestock systems facing with global warming and climate change. They argue that livestock systems will be under pressure by reduced land, rising grain costs and adaptability of livestock genotype to climate brought by global warming. Lambin and Meyfroidt (2011) examine the interaction between deforestation and food production within the developing countries and offer that negative effects of globalization can be reversed by understanding and modelling the land systems as open systems. Smith and Raven (2012) interrogate the concept of protective space and conclude that building the concept properly necessitates a political environment support. Garnett (2013) address the concerns for food and agriculture sustainability with regard to each of the supply chain stages and conclude that the solution relies on an entire restructuring of policies implemented. Heinrichs (2013) discuss sharing economy concept with a special emphasis on its potential to promote sustainable growth. Wu (2013) investigate the landscape sustainability phenomenon and its implications for maintaining humankind well-being.

Specht et al. (2014) discuss the future of the large scale food production on the building, which is refereed as ZFarming, and conclude that the high initial investment costs and low acceptance by people are main obstacles for ZFarming to become prevalent. Kummur et al. (2016) investigate one of the essential topics in sustainability: supply freshwater sustainability. They argue that with the current pace of population growth sustainability of freshwater supply is in a unsustainable trend unless precautionary measures taken. Gao and Bryan (2017) offer global coordination as the sole and most important solution for the landscape degradation. Rockstrom et al. (2017) propose a new approach to achieve agriculture intensification in a sustainable way by meeting rising human demands. Liu (2018) summarize the way China struggled to achieve land use sustainability in face of rapid urbanization.

2.2.3. Sustainability and Business Environment

Shrivastava (1995) investigate corporations' duties and possible contributions for ensuring ecological sustainability. Shediak-Rizkallah and Bone (1998) evaluate the sustainability outcomes of health intervention programs in action and offer three indicators: (i) review of health benefits provided by current program, (ii) institutional capacity of a program, (iii) measuring the capacity level among the relevant community. Daily and Huang (2001) argue that an environmentally conscious management approach beyond the scope of a simple compliance program and investigate top managerial and human resources attitude and implications for environmentally management system. Epstein and Roy (2001) asses the link between corporate managers' encouraging on social responsibility and its positive externalities on sustainability perceptions on society. Sarkis (2001) argue that the manufacturing becomes important component of natural environment and its implications for sustainability needs to be addressed. Gossling et al. (2002) propose a methodology to objectively determine ecological footprints particularly for leisure tourism. van Marrewijk (2003) investigate the concept of corporate sustainability with reference to its historical origins and philosophic foundations. Figge and Hahn (2004) aims to ascertain contributions of corporations to sustainability through a calculating corporate value added to sustainability. Krajnc and Glavic (2005) propose a sustainability index

for companies that evaluate the company's policies in three dimensions of sustainability: environmental, societal and economic. Labuschagne et al. (2005) assess the concept of business sustainability on an industry level and ascertain that available measures of business sustainability are insufficient to evaluate the concept on operational basis.

Sahely et al. (2005) provides a framework for engineers and people in the infrastructure field the foundations of the design of a sustainable urban infrastructure system employing a case study in Ontario, Canada. Sharma and Henriques (2005) examine effect of managerial perceptions to stakeholder expectations on their sustainability practices with their operations. Gordon et al. (2006) discuss sustainability of metal use by considering pure metal resided in lithosphere and recycled use of metal. Ugwu and Haupt (2007) propose a model based on computational methods for sustainability of infrastructure and identify its key performance indicators for a South African case. Singh et al. (2007) aims to evaluate the sustainability performance of the steel industry and offer a sustainability index applicable to this industry's practices. Stubbs and Cocklin (2008) proposed sustainability business model and tested the model's predictions with two case studies. Results showed that stakeholder collaboration is crucial for the adoption of sustainability among corporate level. Artiach et al. (2010) proxied companies with higher corporate sustainability performance by membership of companies to Dow Jones Sustainability Index. Results showed that having higher corporate sustainability performance, membership to Dow Jones Sustainability Index, is associated with higher growth and higher return on equity. Linnenluecke and Griffiths (2010) evaluate emerging corporate sustainability concept and assess the sustainability-oriented organizations. Baumgartner and Ebner (2010) criticize sustainability policies reported in firms' sustainability reports and propose sustainability visions of firms in an objective manner. Dangelico and Pujari (2010) assess firms' green product innovation motivations by employing firm interviews. Schaltegger and Wagner (2011) provide a framework that can be used as a reference by the managers to successfully implement sustainable entrepreneurship through sustainable innovation.

Bouchery et al. (2012) contributes the literature on operations management by an empirical model which also considers a measure of sustainability as a determinant variable. Chabowski et al. (2011) analyze the scope of research on the sustainability topic within the context of marketing studies by employing an extensive review of marketing journals. Orlitzky et al. (2011) evaluate theories of corporate social responsibility and by reviewing empirical results of the recent studies conclude that economic theories of corporate social responsibility are significant, but theories of strategic leadership should be incorporated to these theories. Gimenez and Tachizawa (2012) aims to establish the importance of supplier selection in corporate decision making in terms of sustainability through a detailed literature review. Bansal and DesJardine (2014) argue that time dimension plays a deterministic role in defining corporate sustainability. Beske and Seuring (2014) evaluate the determinants of sustainable supply chain management system and show that companies who achieve sustainability in their supply chain management have distinctive characteristics in common. Eccles et al. (2014) aims to investigate how does the concept of corporate sustainability affect organizations' operations and performance. Cho et al. (2015) delve into concepts of organizational hypocrisy and organizational façades in their relationship between sustainability reporting. Analyzing activities of two multinational petrol and gas companies they conclude that these concepts have limiting effects on organizational sustainability reporting. Papadopoulos et al. (2017) investigate the impact of Big Data analysis on sustainability of supply chain management. Results show that quality of information plays a crucial role in efficiency of Big Data over sustainable supply chain management.

2.2.4. Energy Sustainability

Kemp (1994) evaluate possibilities, institutional requirements of a radical and environmentally friendly technological change in energy systems. Ulgiati et al. (1994) gives an overview of Italian economy from the emergy efficiency perspective. Brown and Ulgiati (1997) propose a sustainability index based on emergy ratios which can be used for assessing an economy's pace of renewable energy efficiency. Ulgiati and Brown (1998) investigates the flows in emergy indices and ratios to assess their

accordance with earth's carrying capacity. Dell and Rand (2001) argue that the requirement of affordable, safe and reliable energy necessitates raising the energy storage capacity to be achieve a sustainable solution. Chappells and Shove (2005) investigate the trends in energy consumption for heating and cooling to ensure indoor comfort and evaluate the sustainability of these trends. Kern and Smith (2008) evaluate Dutch energy transition project experience with regard to its implications for sustainable energy usage. Bradley and Frank (2009) asses plug in hybrid devices' implications for sustainability and energy efficiency. Mudd (2010) using data on Australian mining industry evaluated the future of the mining industry with its implications for sustainability and society. Verbong and Geels (2010) propose three pathways for transition of electricity to a sustainable manner. However, each pathway requires major infrastructure investments. Singh and Olsen (2011) asses biochemical fuels' sustainability outcomes with a special emphasis on algae-based biofuels. Bierbaum and Matson (2013) evaluate the developments in energy industry within the sustainability context and discuss possible consequences for the future of sustainable energy resources. Gebler et al. (2014) investigate the extend of 3D printing technologies' potential for sustainable development through energy saving offered by this technology.

Santoyo-Castelazo and Azapagic (2014) applied eleven different scenarios to forecast sustainability of electricity supply in Mexico by employing 17 different criteria of sustainability. Schaubroeck et al. (2015) examine greenhouse gas emissions due to a sewage treatment plant in Austria and the improvements achieved through partial nitrification within this plant. Sueyoshi and Yuan (2015) show that the Chinese government should emphasize strict energy saving policies to attain industrial development in a sustainable way. Casals et al. (2016) investigate the sustainability gains achieved through electric vehicle use and show that some European countries should implement promotion policies more extensively while decarbonization effects of electric vehicle use appear gradually in some other countries. Sun et al. (2017) evaluate policies implemented to recover critical metals from electronic waste which are crucial for renewable energy sources to become widespread. Cai et al. (2019) analyze current practices of energy saving attitudes within the manufacturing industry that contribute sustainable production practices of the industry. Li et al. (2021)

investigate the scope of energy saving that is attainable through electrochemical reactions between water and nitrogen as an alternative to fossil fuels.

2.2.4. Societal Outcomes of Sustainability

Rosenbloom (2001) aims to ascertain the sustainability issues brought by transformation of world's elderly population and transformation of their mobility choices from public transport to personal car. Elderly population is more likely to contribute carbon emissions during driving and these transformations will have sustainability implications. Barr (2003) argue that there are factors that influence individuals' environmentally responsible behavior and policies aiming to encourage these behavior should take into consideration of these factors. Kremer and Miguel (2007) employ a randomized experiment in Kenya and show that one-time intervention failed to achieve sustainable outcomes. Ness et al. (2007) provide a categorization of tools for assessment of sustainability. They categorized tools for assessment of sustainability with respect to their nature-society system integration. MacDonald (2010) analyzed the drought in southwest US and show that with current population growth and water use growth policy makers should act for future sustainability. Smith, Roheim, et al. (2010) assess consumption, share in total protein intake and international trade of sea food in order to assess its sustainability of production. Their results show that the developing countries policy implications are crucial for sea food sustainability. Smith, Voss, et al. (2010) review literature on sustainable development and innovation. They also propose a multi-level perspective on societal outcomes of technical transitions. Dempsey et al. (2011) by offering a new definition for urban sustainability discuss the opportunity of equal access for every of the society. Ahern (2011) argues that transformation of urban resilience from fail-safe to safe-to-fail is crucial for urban sustainability. Jerneck et al. (2011) assert that sustainability science needs to be urgently structured to overcome sophisticated implications of related subjects on social wellbeing. Shen et al. (2011) evaluated nine different cities in a comparative manner to determine urban sustainability indicators. Cucek et al. (2012) gives a detailed review of sustainability assessment based on footprint analysis.

Mori and Christodoulou (2012) examine available sustainability indices and indicators to propose a novel city sustainability index. Ahern (2013) discuss sustainability challenges brought by urban transformation, sustainable cities from the perspective of landscape ecologists. Wittmayer and Schapke (2014) investigate the role of researchers as a mediator for establishing conception of sustainability transition among society. Wolch et al. (2014) investigate the importance of urban green spaces to maintain social and ecological sustainability. Wu (2014) argue that landscapes and ecosystems are under threat by escalating urbanization but our improving knowledge about pace of the urbanization and scientific developments may offer a remedy for the unsustainable course of landscape and ecosystem degradation. Grunert et al. (2014) analyzed 4408 respondents survey results to awareness on sustainability and reasoning of food labeling. Results showed high levels of awareness on food labels but limited awareness on sustainability. Tilman and Clark (2014) examine the links between transition of dietary habits and greenhouse gas emissions and health outcomes. They attribute dietary solutions as one of the most important determinant of sustainability challenges. Bennett et al. (2015) discuss the challenges and opportunities of the Future Earth project which aims to enhance future of the ecosystem services and interactions between humankind and ecosystem. Martin (2016) argue that whilst the sharing economy phenomenon offered promising outcomes in terms of sustainability with its current pace it may convert into an obstacle rather than a solution.

2.2.5. Sustainability and Genetic Diversity

Larsen (1995) emphasize genetic variation as a crucial determinant for forest stability due to its impacts on resistance and resilience of the ecosystem and demonstrate that forests and genetic diversity is in an extensive decline during last 15 years. Zhu et al. (2000) applied a controlled experiment for the effects of crop diversification on resistance to disease. Results showed that heterogeneity of crop is highly effective in resistance to diseases. Hilborn et al. (2003) examine Bristol Bay fisheries in their success for sustaining production while fisheries sustainability is under question all around the world. Result show that success is mainly attributable to biodiversity generated by the location of the fisheries. Tisdell (2003) examine socioeconomic causes of transformation in animal husbandry and reduction in genetic

diversity in livestock and show that the recent trend brought by excess competition in animal husbandry is unsustainable. Allan et al. (2005) discuss fisheries' sustainability problem for inland waters and conclude that crisis is about biodiversity rather than fisheries. Rudel et al. (2005) evaluate outcomes of forest transition on biodiversity and conclude that its positive impacts on biodiversity is limited and changes from location to location. Metzger et al. (2006) examine land use change vulnerability of 14 different land use types defined in Advanced Terrestrial Ecosystem Analysis and Modelling project by comparing 1990 situation with 2080 forecasts. Results show that governmental and social action is required to mitigate impact of land use changes. Toledo and Burlingame (2006) discuss the link between biodiversity and food security within the context of international initiative of The Food and Agriculture Organization (FAO). The initiative aims to promote use of biodiversity in food security programs in a sustainable way.

Brussaard et al. (2007) showed that biodiversity of soil reduces crops' vulnerability to diseases and stress. Spangenberg (2007) evaluate the strategy to quantitatively determine socioeconomic factors that contribute to biodiversity reduction in Europe. Broadhurst et al. (2008) evaluate seed sourcing for the efficiency of crop yield and suggest use of a combination of local seed and diverse seeds rather than pure local seed for the efficient crop yield. Polidoro et al. (2010) argue that rapid loss of mangrove areas drives mangrove species to extinction; 16% of mangrove species and 40% of mangroves in Central America are threatened by extinction. Frison et al. (2011) argue that genetic diversity is not only crucial for food security it also enhances productivity through its contributions on soil fertility and mitigating harming impacts of pests and diseases providing resilience to farming ecosystems. Hoffmann (2011) showed that countries over a certain income level and ensure food security beyond a certain level are more successful and more likely to attach importance to monitoring and conserving breed population. Aguilar et al. (2015) compared crop diversity of US with 2012 and 1978. Results showed that on a national basis crop diversity is lower in 2012 than in 1978. However, county level diversity data is differentiated, in some counties crop diversity is higher in 2012 than in 1978.

2.3. Market Mechanism and Tragedy of the Commons

In his seminal paper, Gordon (1954) provided underlying economic foundations that pave the way for over-exploitation of open-access resources through an economic model of fishery. He showed that, in the absence of property rights, the race for extracting more fish motivates each fisher to utilize fishing grounds inefficiently. In short, the economic benefits of overfishing are exploited by individual fishers, while the environmental costs are endured by all of society. Therefore, the common resource nature of fisheries precludes an individual fisher from conservative motives, since an individual's sacrifice will obviously be inconsequential unless all others behave in the same manner (Tasneem et al., 2019).

Such depletion resulting from the inevitable selfish actions of individuals against common resources is termed by Hardin (1968) as “the tragedy of the commons.” As Coase (1960) presents the tradable emission rights for the alleviation of air pollution from an economic standpoint, the remedy to the tragedy of the commons lies in internalizing the costs that are external to the free-riders through well-defined property rights and efficiently functioning competitive markets.

The wildlife management schemes starting at the end of the 1960s, based on devolving ownership of wildlife to the local community in some Southern African countries (Zimbabwe, Botswana, Namibia and South Africa), demonstrate significant implications of providing economic incentives to individuals for the conservation of a previously commonly held and depleted resource. These countries host great herds of African elephant, whose existence was threatened by relentless poaching for their commercially valuable ivory during the end of the 1970s.

Conservative antipoaching measures are highly costly and hard for the authorities to implement, since elephant herds span huge areas and the local community facing the harm animals tends not to be eager to cooperate unless they attach sufficient value to them (De Alessi, 2004). Southern African countries, instead of enforcing conservative measures, delegated property rights to land owners for the elephants on their lands and legalized touristic hunting and sale of meat, thus enabling

local communities to benefit economically from both the use values and non-use values of the elephants on their land (Kay & Robert, 2000; Khanna & Harford, 1996; McPherson & Nieswiadomy, 2000). These countries succeeded in overturning the deterioration trend in the elephant population.

Elephant population estimates of Stiles (2004) are shown in table 2.1. According to these estimates during the decade following 1979, the elephant population within the South Africa declined by 28%, which is far less than the 62% decline of the population experienced throughout the remainder of the continent. Moreover, contrary to the ongoing deterioration of the elephant population within the remaining continent, South Africa achieved gains in the elephant population during the two decades following 1990.

Although the natural experiment in the South African countries provided promising outcomes concerning the success of property rights and the market mechanism as a cure for the tragedy of the commons, this cure demonstrates intimate fallacy in terms of sustainability, which has become acutely evident during the last decades. Taberlet et al. (2008) showed that cattle, sheep, and goats, which have been privately owned and prevented from extinction for thousands of years, are subject to a serious threat that would be ignored by an analysis based solely on the supply-and-demand dynamics of the free market mechanism.

Recently, pursuit of higher profit and higher productivity and shrinkage of grazing lands due to land transformation soared because of the intensive competition brought by globalization. Along with these economic pressures, advances in therapeutics and the advent of industrial breeding exacerbated the switch of farmers to more productive and profitable industrial breeds in place of local breeds, which have been selected during human history by surviving challenges of nature (Medugorac et al., 2011; Taberlet et al., 2008).

Local breeds' risk of extinction and thus the potential loss of genetic diversity has escalated in recent decades (Zhang et al., 2018). According to trends in the risk status of the local breeds data of the Food and Agriculture Organization (FAO), the percentage of local breeds of cattle, sheep, and goats classified as "at risk" increased

to 28.4% as of 2018 from 14.8% in 1990, and 51 of these local breeds became extinct during this period (FAO, 2019). The market mechanism left solely to its own devices produced an unsustainable outcome: local breeds, which represent invaluable genetic sources in light of the traits of adaptation to tough environmental conditions and resistance to diseases, now face the risk of extinction as a result of short-sighted, profit-seeking motives (Belabdi et al., 2019; Taberlet et al., 2008).

Copeland and Taylor (2009) propose a theory which determine countries' ability to avoid tragedy of the commons by three measures: enforcement power of the authority, the extent with which harvesting take place and the resource's ability to generate competitive return. In their experimental study Gillet et al. (2009) showed that groups are much more groups behave less short sighted than individuals in terms of exploitation of a common resource but they become more competitive when the game is repeated in a strategic setting. Libecap (2009) discuss market mechanism and private property rights as a remedy for tragedy of the commons and evaluate alternative policies' advantages and disadvantages. McWhinnie (2009) show that the effect of international sharing on fish stock is detrimental. Fish stocks subject to international sharing are more vulnerable to overexploitation. Hannesson et al. (2010) examine effect of technological progress on productivity for a common resource-based system using 130 years of data from an open access fishery. Empirical results showed that rise in labor productivity lagged total factor productivity. Authors attribute this result to neutralization of gains in technology by loss of fish stock.

Fehr and Leibbrandt (2011) by combining experimental data with data from field studies, confirm the economic theory's prediction on fisherman's behavior that those behaving less short sighted are less probable to overexploit fisheries. Long and McWhinnie (2012) propose a model which shows that fishermen's endeavor for after tax profit by considering their performance relative to other fishers, results in lower fish stock and lower profit for all fishermen. In the experimental study Aflaki (2013) show the differences in individuals' attitudes towards common resource with increased risk and increased ambiguity. Results show that while increased risk may induce individuals to selfish behavior increased ambiguity may induce the opposite. Fesselmeyer and Santugini (2013) with a theoretical model showed that when

renewability and quality of common resource is at risk due to an environmental change, conservative behavior of individuals exacerbate the tragedy of the commons.

Table 2.1: Elephant population estimates (number of elephants) 1979–2002 in Africa

Area	1979	1989	1991	1998	2002
West Africa	17,100	18,480	10,100-16,800	3,100-12,800	5,460-13,180
Central Africa	497,400	275,600	268,000	34,400-125,500	16,450-195,750
Eastern Africa	546,000	110,650	102,000-122,000	106,500-125,200	117,720-163,670
Southern Africa	282,000	203,300	168,700-244,700	213,900-236,700	246,590-303,920
Total	1,343,100	608,030	548,800-651,500	357,900-500,200	386,220-676,520

Source: Stiles (2004)

3. DATASET AND METHODOLOGY

3.1. Methodology

Following Chevalier et al. (2003) we use seemingly unrelated regression (SUR) for the analysis of response of sheep price; before, during and after the Eid period.

In order to deduce SUR methodology comprehensively we first derive a multivariate model. Equation 3.1 shows a univariate regression model where dependent variable (y_i) is regressed on k independent variables ($x_1, x_2, \dots, x_k$) with n observations:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik} + \varepsilon_i \quad (3.1)$$

which can be rewritten as:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_{11} & x_{12} & \dots & x_{1k} \\ 1 & x_{21} & x_{22} & \dots & x_{2k} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & x_{n1} & x_{n2} & \dots & x_{nk} \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix} \quad (3.2)$$

and then equation 3.2 in matrix form becomes

$$\mathbf{y}_{nx1} = \boldsymbol{\beta}_{qx1} \mathbf{X}_{nxq} + \boldsymbol{\varepsilon}_{nx1} \quad (3.3)$$

where $q = k + 1$.

The coefficients estimated with ordinary least squares (OLS) for a univariate regression model are shown in equation 3.4:

$$\hat{\beta} = (X'X)^{-1}X'y \quad (3.4)$$

A multivariate equation system with p different response variables differs from a univariate equation system as in equation 3.5 where y_j , x_j and e_j are $n \times 1$ vectors for $j = 1, 2, \dots, p$.

$$\begin{array}{rclclclclcl} y_1 & = & \beta_{01}\mathbf{1}_n & + & \beta_{21}x_1 & + & \dots & + & \beta_{k1}x_k & + & \varepsilon_1 \\ y_2 & = & \beta_{02}\mathbf{1}_n & + & \beta_{22}x_1 & + & \dots & + & \beta_{k2}x_k & + & \varepsilon_2 \\ \vdots & & \vdots & & \vdots & & & & \vdots & & \vdots \\ y_p & = & \beta_{0i}\mathbf{1}_n & + & \beta_{2p}x_1 & + & \dots & + & \beta_{kp}x_k & + & \varepsilon_p \end{array} \quad (3.5)$$

For $N = np$ and $K = p(k + 1)$ We can rewrite equation 3.5 in matrix form as:

$$y_{NX1} = (I_P X)_{NXK} \beta_{KX1} + \varepsilon_{KX1} \quad (3.6)$$

and coefficients estimated by OLS for multivariate model is as follows:

$$\hat{\beta} = (X'X)^{-1}X'Y \quad (3.7)$$

As can be seen in equation 3.7 within multivariate linear regression framework explanatory variables (X) are same for all dependent variables that does not allow for varying explanatory variable matrices for different dependent variables (Y) which may lead to overestimation or misspecification of some dependent variables.

Seemingly unrelated regression proposed by Zellner (1962, 1963) enable to estimate each dependent variable by different explanatory variables simultaneously within an overall estimation framework.

Replacing X with X_j then mean of Y becomes

$$\begin{aligned}
 E(Y_{n \times p}) &= [X_1\beta_1, \quad X_2\beta_2, \quad \dots, \quad X_p\beta_p] \\
 &= [X_1, \quad X_2, \quad \dots, \quad X_p] \begin{bmatrix} \beta_1 & 0 & \dots & 0 \\ 0 & \beta_2 & \dots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \dots & \beta_p \end{bmatrix} \\
 &= XB
 \end{aligned} \tag{3.8}$$

and the SUR model becomes (Johnston & Dinardo, 1997; Neil, 2002; Pindyck & Rubinfeld, 1988):

$$y_{j(n \times 1)} = X_{(n \times q_j)}\beta_{j(q_j \times 1)} + e_{j(n \times 1)} \tag{3.9}$$

Kim et al. (2000) model the determinants of American Depository Receipts using SUR approach and show that exchange rate and United States market Index have impact on American Depository Receipts as well as the prices of relevant shares covered within American Depository Receipts. Noland (2001) empirically examines the theory asserting that extending highway network induces more vehicles in the traffic and so higher traffic on the roads using US data on travel miles and lane mileage. SUR regression results support the theory: travel miles are positively associated with lane mileage. Pastor and Stambaugh (2002) propose an alternative to traditional metrics such as Alpha and Sharpe Ratio by including history of the returns on assets which are seemingly unrelated with the asset in consideration in calculating these metrics. Results show that alternative metric enhances efficiency of traditional metrics in measuring investment performance of an asset. Reynaud (2003) models water demand of industrial entities in Gironde, France using SUR framework. They estimated both water demand elasticity of treated water price and network water price which are at -1.42 and -0.29 respectively.

Long (2004) evaluate relationship between changes in the affirmation policies of colleges and the public's behavioral change in applications to colleges. SUR model regression results show that as student's probability of acceptance decrease applications by students from minority groups significantly fall while applications by students from non-minority groups significantly rise to top schools. Brons et al. (2008) investigate price elasticity of gasoline using SUR model show that demand of gasoline is not price sensitive rather drivers' response to gasoline price changes with fuel efficiency. Dordonnat et al. (2008) proposed a model for forecasting French electricity load on a national scale. Forecasting model based on SUR methodology considered the implications of peak demand periods and weather effects. Cao et al. (2009) examine non-motorized travel attitudes of residents using survey data from a sample in Northern California with SUR model. Their results are encouraging for policy makers to promote non-motorized travel among residents. Bhaird and Lucey (2010) tested fourteen hypotheses on small and medium sized enterprises' (SMEs') financing structures using seemingly unrelated regression employing data from 209 survey response among Irish SMEs. Results showed that firms invoke higher internal equity as they grow and the importance of collateral in SME financing. Fingleton et al. (2012) using SUR model showed that the NUTS-1 regions of United Kingdom differ in their resilience to employment shocks. They also employed a vector error correction model to analyze interregional spillovers of employment shocks. Gimenez-Nadal and Molina (2013) analyzing sample from Spain and United Kingdom within SUR framework showed that childcare time devoted by parents is associated with mother's education level rather than father's education level.

3.2. Dataset

Statistical Institute of Turkey (TUIK) provides monthly per-head prices of sheep (both ewes and rams separately) in the 81 provinces (NUTS-3 level) of Turkey. Monthly prices are the average of every transaction price of ewes and rams during the month, as recorded by officers of the country's Ministry of Agriculture and Forestry in relevant regions and reported to the TUIK. Our dataset consists of the monthly prices of ewes and rams in each province, the monthly rainfall in each province, the

monthly average fodder price in each province, and the monthly consumer price index (CPI) values in 26 regions (NUTS-2 level) for January 2005-December 2017. The yearly gross domestic product (GDP) per capita of each province, yearly reserve of ewes and rams of each province, yearly population of each province, and yearly number of students registered to Quranic lectures are organized by the country's Directorate of Religious Affairs in each province for 2005-2017. Descriptive statistics of the variables in the dataset are reported in table 3.1.

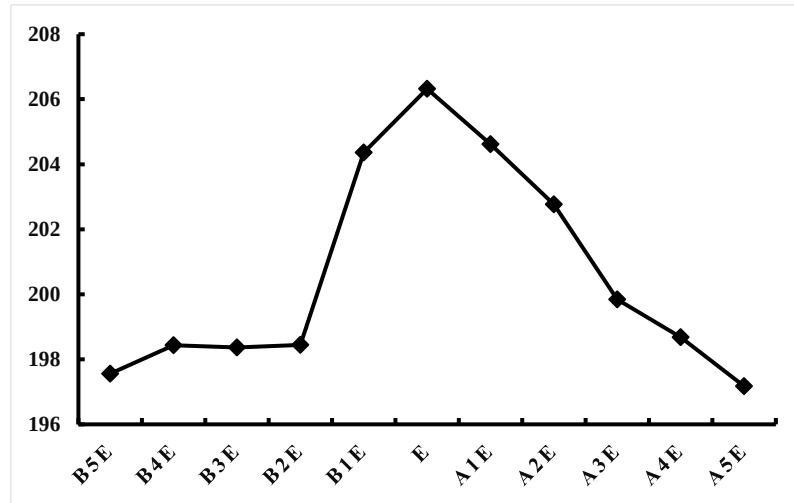
Figure 3.1 illustrates the adjustment of the prices of ewes and rams throughout the Eid month from the previous five months to the following five months of the Eid month. It is evident from the figure that prices tend to rise as Eid approaches, peaking during the Eid month and then declining to an almost initial level within the five-month period.

Table 3.1 Descriptive Statistics of Variables

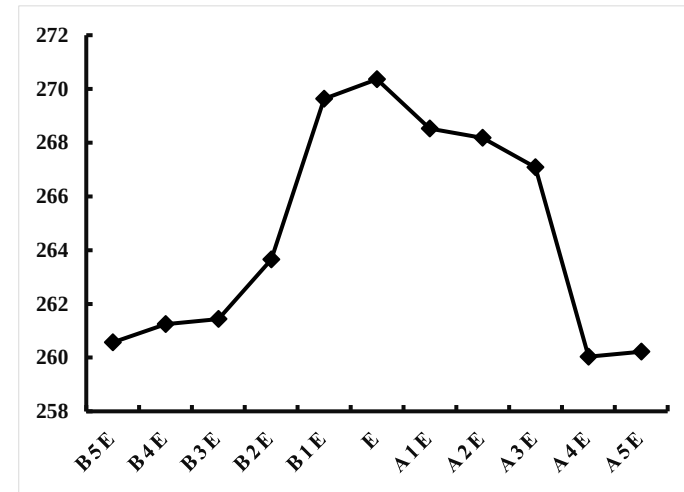
Variable	Observations	Mean	Std. Dev.	Min.	Max.
Price of Ewes	12608	209.7	51.1	107.5	488.6
Price of Rams	12602	278.5	72.6	120.5	645.4
Rainfall	12636	52.7	55.3	0.0	639.8
Price of Fodder	11736	150.1	55.2	44.8	449.5
GDP per Capita	12636	7492.4	2827.7	2406.3	21364.1
Reserve of Ewes	12636	311.6	367.5	1.8	2783.4
Reserve of Rams	12636	23.7	37.9	0.0	322.2
Number of Quranic Lecture Registrants	12636	7.7	7.8	0.0	41.9

Notes: Reserve of ewes, reserve of rams, and number of Quranic lecture registrants are represented per thousand population. GDP per capita, price of fodder, and prices per head of ewes and rams are in 2003 Turkish Lira (TL). TL depreciated against the United States Dollar from 0.74 in January 2005 to 0.26 in December 2017

(a) Price of Ewes



(b) Price of Rams



Notes: Each observation in the figure corresponds to the median price of the livestock in 2003 TL for the relevant month. *B1E* to *B5E* represent one month before to five months before the Eid month, *E* represents the Eid month, and *A1E* to *A5E* represent after one month to after five months of the Eid month, respectively.

Figure 3.1 Price Adjustment Before, During, and After Eid Month (2003 TL)

3.2.1. Prices of Ewes and Rams During the Analysis Period

Price of sheep have significant welfare implications for the society as an important protein source within the nutrition. In this section we examine stability of the real per-head price of sheep.

Price of sheep are presented in figures 3.2 and 3.3. These figures present monthly median prices of ewes and rams in 2003 Turkish Lira (TL). It is evident from the figures that sheep prices escalated starting with mid-2009. Price of ewes peaked to 300 TL (2003 TL) from 145 TL and price of rams in similar fashion peaked to 370 TL from 200 TL in roughly two years. Price of sheep nearly doubled in two years' time. This finding requires further empirical inspection to objectively determine causes resulting in such situation, but this is out of scope of this research. Further, tables 3.2 and 3.3 show the highest 10 and lowest 10 provinces for median price of ewes and rams during the analysis period.

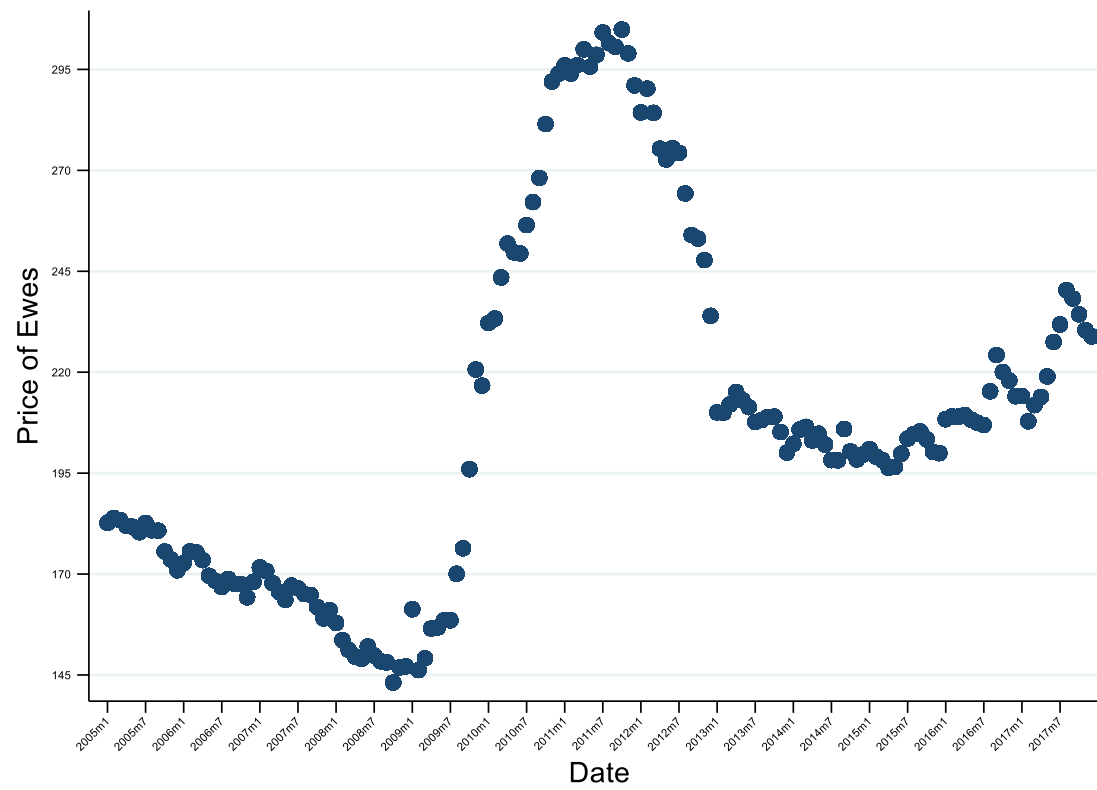


Figure 3.2: Price of Ewes (2003 TL)

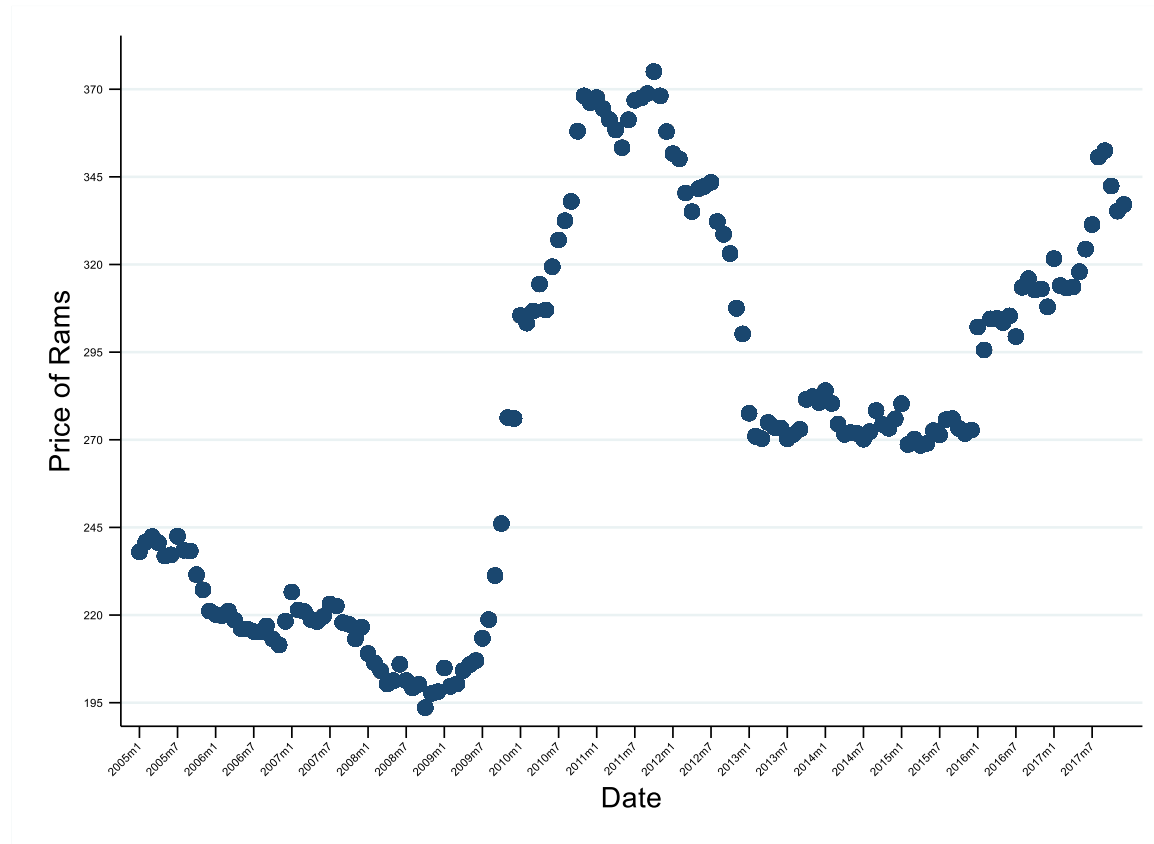


Figure 3.3: Price of Rams (2003 TL)

Table 3.2 Median Price of Ewes (2003 TL): Highest and Lowest 10 Provinces

#	Province	Price
Highest 10		
1	Tekirdag	260.76
2	Izmir	252.01
3	Osmaniye	234.26
4	Edirne	226.77
5	Antalya	225.21
6	Artvin	224.80
7	Sivas	224.79
8	Nigde	223.78
9	Nevsehir	223.58
10	Bingol	223.29
Lowest 10		
1	Kars	162.66
2	Sinop	169.42
3	Duzce	170.64
4	Mardin	171.10
5	Hakkari	171.44
6	Mugla	173.17
7	Diyarbakir	177.00
8	Bayburt	177.90
9	Agri	180.08
10	Mus	180.88

Table 3.3 Median Price of Rams (2003 TL): Highest and Lowest 10 Provinces

#	Province	Price
Highest 10		
1	Sivas	384.12
2	Nevsehir	383.34
3	Balikesir	353.92
4	Izmir	342.65
5	Antalya	340.78
6	Aksaray	337.63
7	Kayseri	326.25
8	Tekirdag	324.66
9	Yozgat	321.43
10	Kirikkale	318.24
Lowest 10		
1	Kars	213.90
2	Ardahan	216.53
3	Igdir	218.48
4	Bilecik	218.48
5	Mus	220.19
6	Tunceli	223.96
7	Karaman	226.48
8	Bartın	228.18
9	Siirt	229.69
10	Elazığ	230.88

3.2.2. Relationship Between Sheep Price and Cumulative Rainfall

With higher rainfall (cumulative of last six months) sheep are expected to be better nourished, weight higher, and have higher price. In this section we examine this prior expectation with actual data.

Figures 3.4 & 3.5 depict relationship between monthly median six-monthly cumulative rainfall and monthly median prices of ewes and rams respectively during the analysis period of January 2005 – December 2017. Both prices of ewes and rams are positively correlated with six-monthly cumulative rainfall. Sheep price tend to be higher for the higher six-monthly cumulative rainfall and correlation coefficients are 0,1356 and 0,0906 for ewes and rams respectively. Further, table 3.4 shows the highest 10 and lowest 10 provinces for median rainfall during the analysis period.

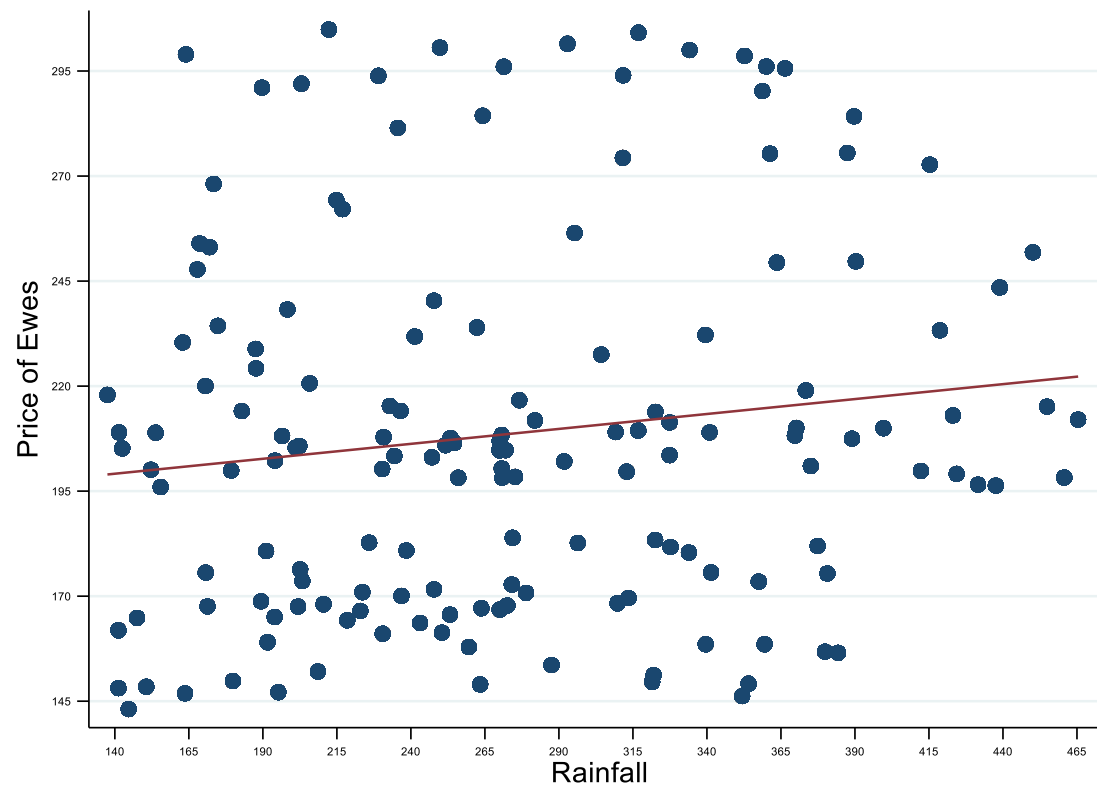


Figure 3.4: Price of Ewes & Rainfall

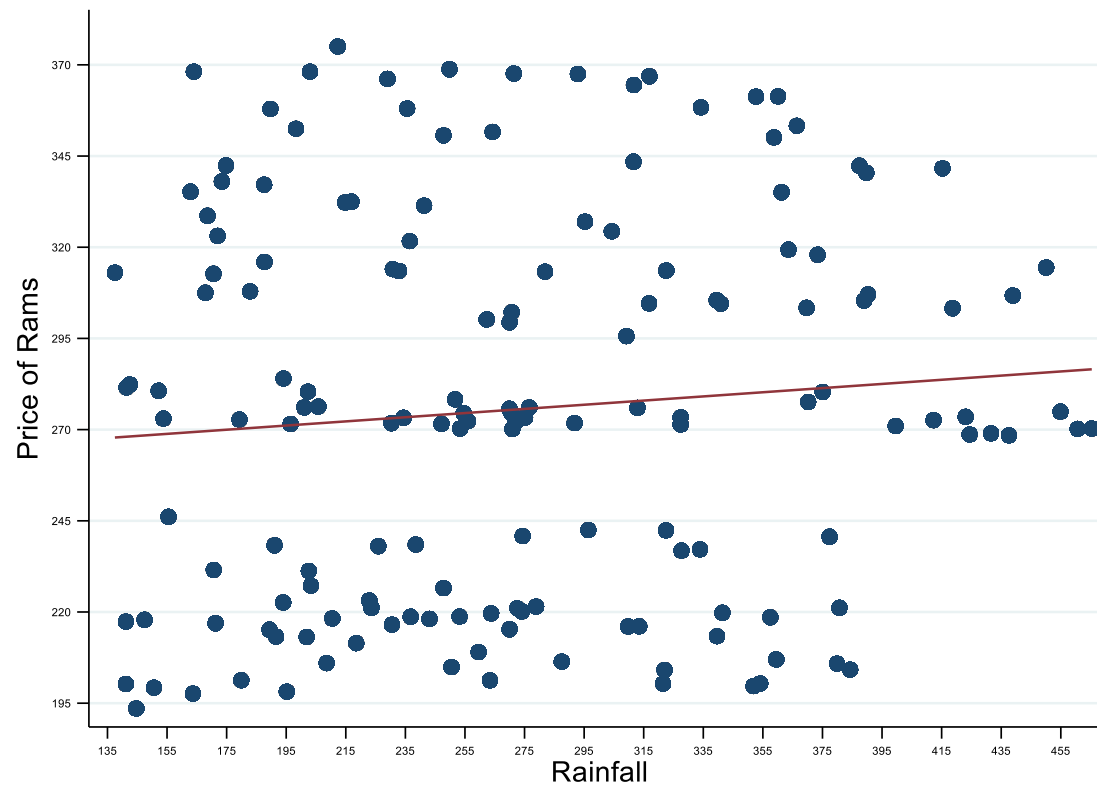


Figure 3.5: Price of Rams & Rainfall

Table 3.4 Median Rainfall: Highest and Lowest 10 Provinces

#	Province	Price
Highest 10		
1	Rize	1187.45
2	Giresun	674.60
3	Zonguldak	587.15
4	Ordu	542.80
5	Bartın	541.85
6	Mugla	523.75
7	Bitlis	520.55
8	Hatay	489.25
9	Sakarya	423.20
10	Bingöl	415.95
Lowest 10		
1	Iğdir	136.70
2	Karaman	154.00
3	Konya	156.60
4	Aksaray	158.45
5	Eskişehir	163.40
6	Malatya	164.75
7	Niğde	165.80
8	Erzurum	172.15
9	Sanliurfa	172.30
10	Elazığ	177.15

3.2.3. Relationship Between Sheep Price and Fodder Price

Fodder is one of the most important ingredients in nourishment of the sheep. With higher fodder price input prices of sheep production rise and sheep price is expected to rise. In this section we examine this prior expectation with actual data.

Figures 3.6 & 3.7 depict relationship between monthly median fodder price and monthly prices of ewes and rams respectively during the analysis period of January 2005 – December 2017. Both prices of ewes and rams are positively correlated with fodder price. Sheep price tend to be higher for the higher fodder price and correlation coefficients are 0,1726 and 0,2774 for ewes and rams respectively. Further, table 3.5 shows the highest 10 and lowest 10 provinces for median fodder price during the analysis period.

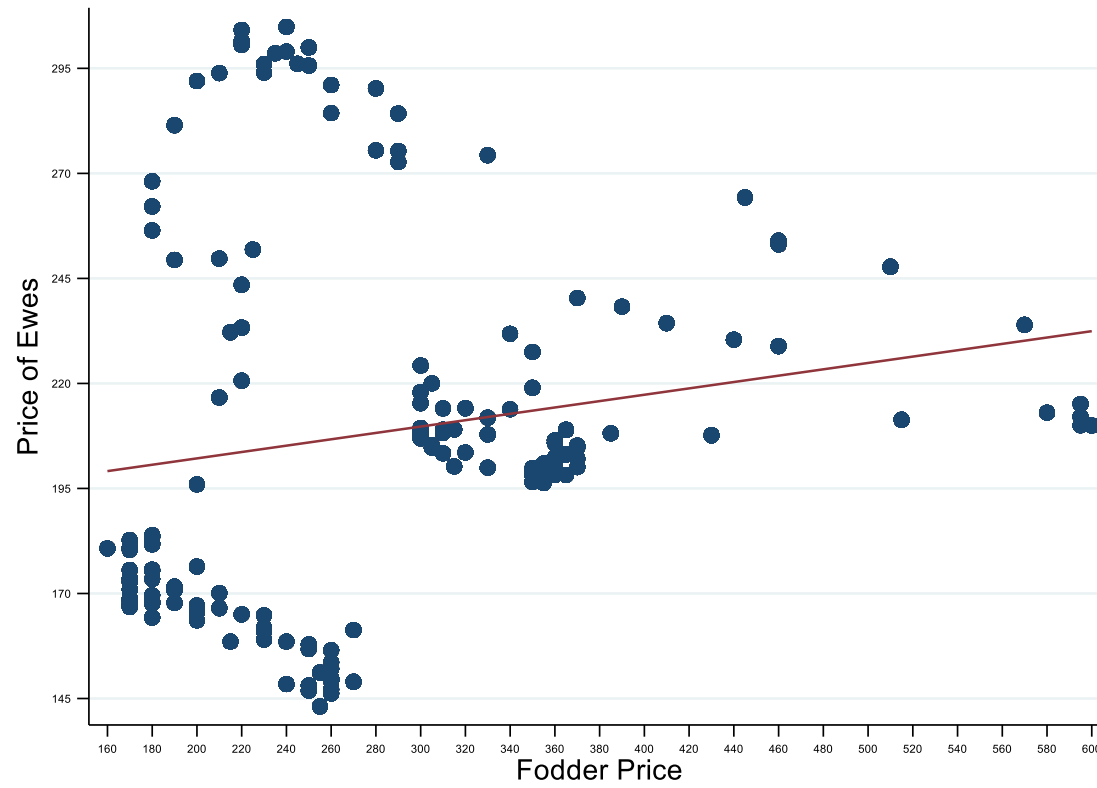


Figure 3.6: Price of Ewes & Fodder Price (2003 TL)

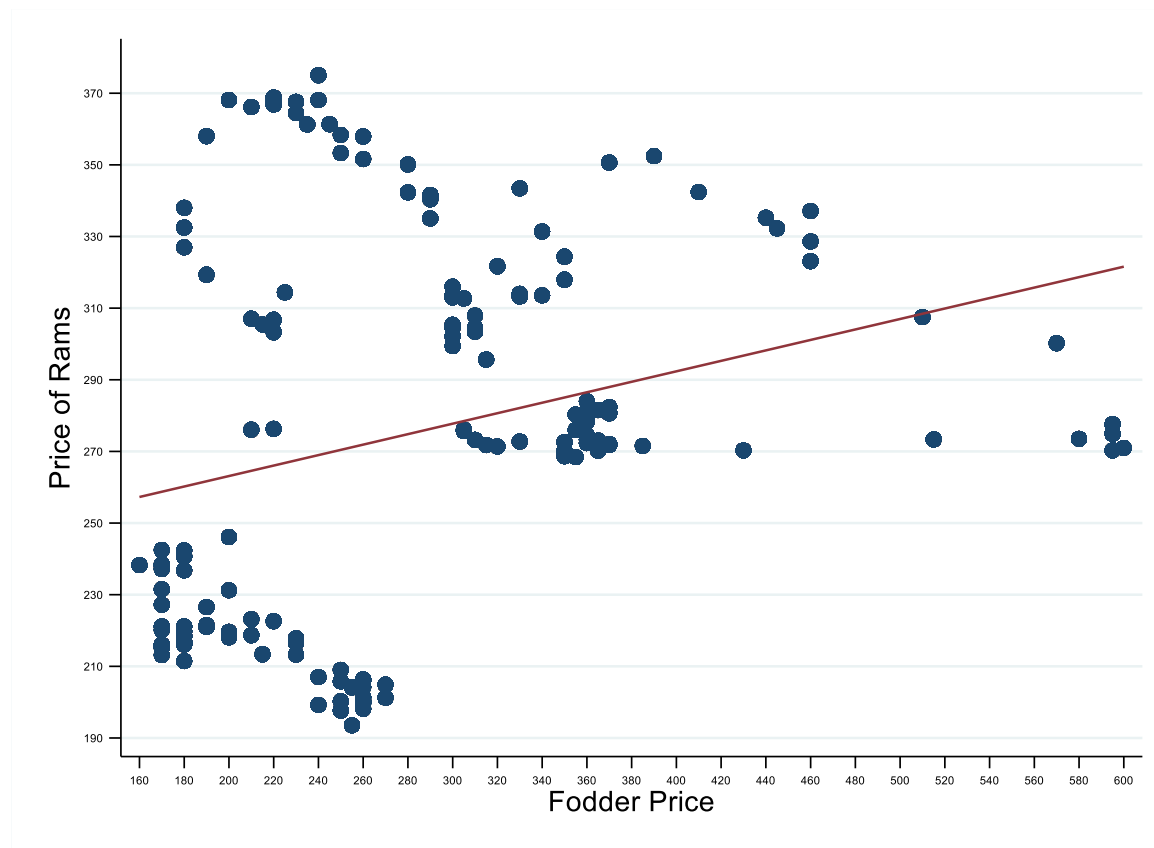


Figure 3.7: Price of Rams & Fodder Price (2003 TL)

Table 3.5 Median Fodder Price: Highest and Lowest 10 Provinces

#	Province	Price
Highest 10		
1	Bartın	740.00
2	Zonguldak	455.00
3	Artvin	430.00
4	Yalova	400.00
5	Giresun	400.00
6	Siirt	380.00
7	Antalya	380.00
8	Ordu	370.00
9	Ardahan	350.00
10	Hakkari	340.00
Lowest 10		
1	Canakkale	170.00
2	Eskisehir	180.00
3	Kirklareli	190.00
4	Adiyaman	200.00
5	Edirne	200.00
6	Kocaeli	200.00
7	Kayseri	205.00
8	Diyarbakir	210.00
9	Bilecik	210.00
10	Tekirdag	210.00

3.2.4. Relationship Between Gross Domestic Price (GDP) per Capita and Price of Sheep

As a normal good, demand for sheep rise with higher income level. The higher demand implicates higher price of the sheep in relevant province. In this section we examine this prior expectation with actual data.

Relationship between each provinces' yearly GDP per capita in 2003 TL and median price of ewes and rams are presented in figures 3.8 and 3.9. Both prices of ewes and rams are positively correlated with GDP per capita of the province. For provinces with higher GDP per capita price of ewes and rams tends to be higher with correlation coefficients: 0.3273 and 0.4809 respectively.

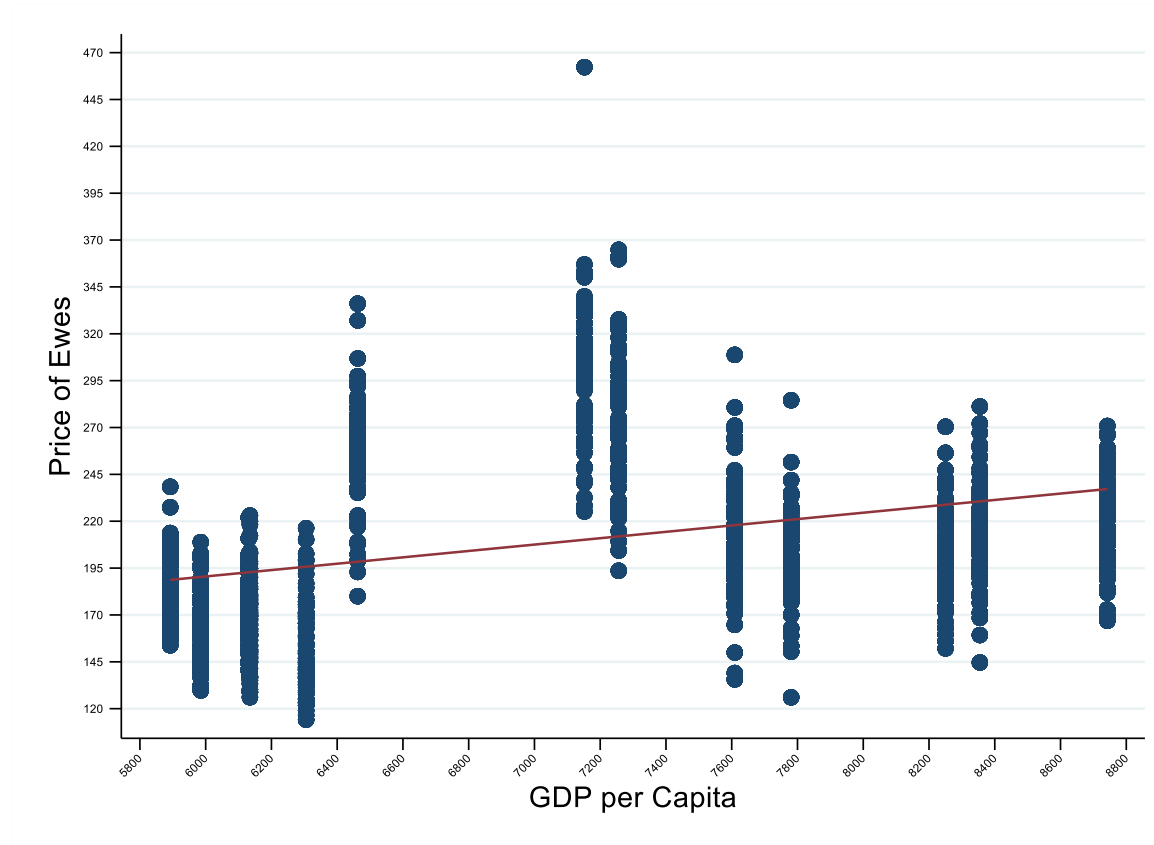


Figure 3.8: Price of Ewes & GDP per Capita (2003 TL)

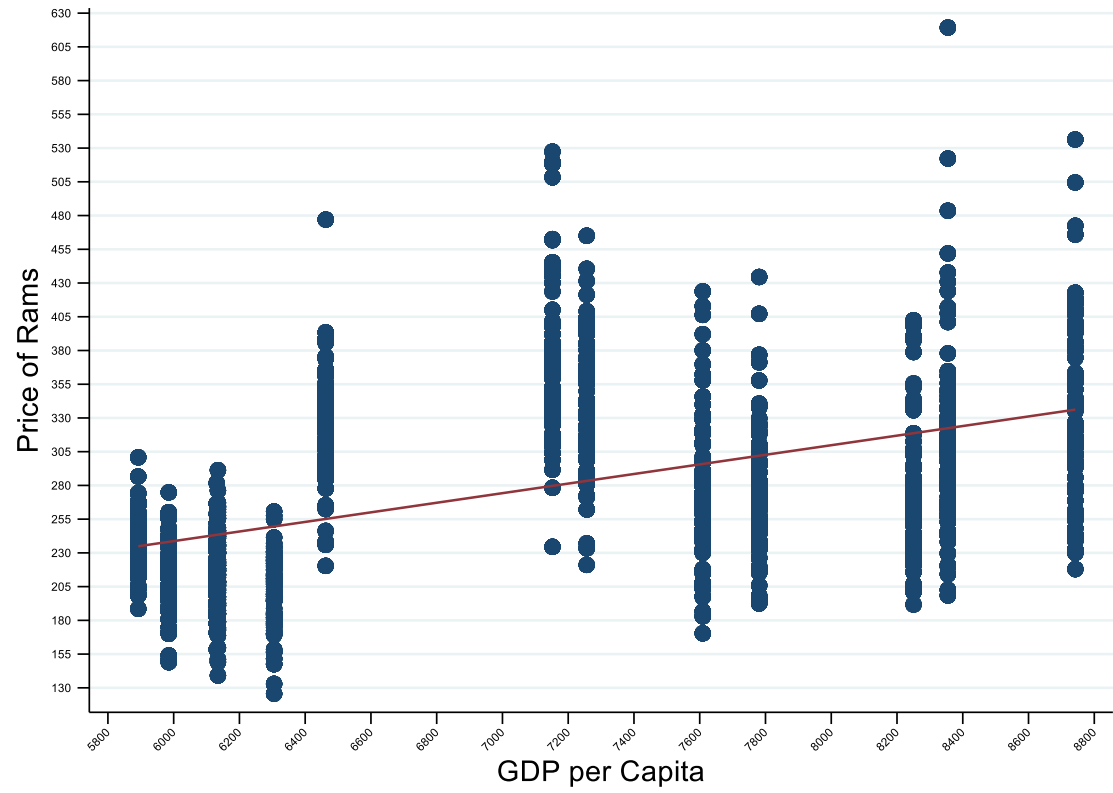


Figure 3.9: Price of Rams & GDP per Capita (2003 TL)

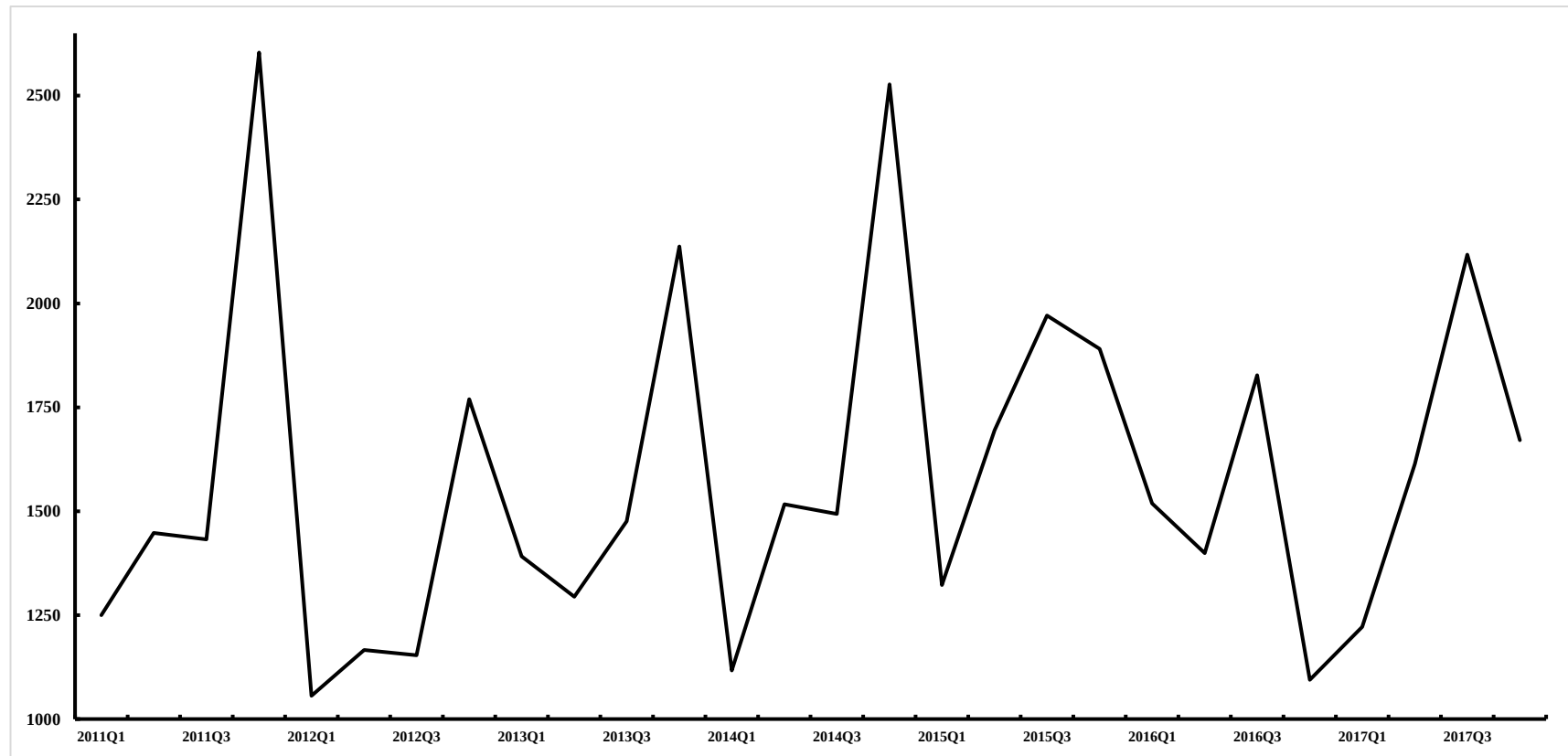
Table 3.6 Median GDP per Capita: Highest and Lowest 10 Provinces

#	Province	Price
Highest 10		
1	Istanbul	16088.72
2	Kocaeli	15366.32
3	Ankara	14087.64
4	Tekirdag	12487.80
5	Antalya	12104.38
6	Bilecik	11823.33
7	Izmir	11507.14
8	Bolu	11097.82
9	Bursa	10961.24
10	Kirklareli	10649.17
Lowest 10		
1	Agri	3153.81
2	Van	3518.79
3	Sanliurfa	3764.38
4	Bitlis	3966.16
5	Hakkari	4176.67
6	Mus	4410.42
7	Bingol	4521.02
8	Adiyaman	4549.54
9	Kars	4602.38
10	Sirnak	4663.76

3.2.5. A Natural Experiment for Price Adjustment During an Excess Demand Shock

In the following sections, we empirically analyze the adjustment of the per-head prices of sheep by employing a natural experiment of excess demand shock in order to examine the efficiency of the market mechanism in handling a huge demand shock. Muslims sacrifice sheep during the Eid period starting on the 10th of the Dhu'l-Hijja month (12th month) of the Islamic lunar calendar. During Eid, massive numbers of sheep are sacrificed in just four days. For instance, 2,720,271 head of sheep (almost 41% of the year's total) were slaughtered during the four days of the Eid period in 2017 in Turkey.¹ Figure 3.10 presents the total number of sheep slaughtered during the year. Huge hikes in the figure correspond to instances including the Eid period.

¹Number of sheep slaughtered during the Eid period is based on data from a news bulletin of the Ministry of Agriculture and Forestry of Turkey on Eid al-Adha in 2017.



Source: TUIK

Figure 3.10 Number of Sheep Slaughtered in Turkey (2011Q1-2017Q4, Thousand Head)

3.3. Empirical Model

Our model for the empirical analysis is presented in equation 3.10, where p_{ijt} is the logarithm of the per-head price of livestock i in region j at time t , Eid is the dummy variable which equals 1 for the months including the Eid period (Eid months), t and t^2 are linear and quadratic time trends, p_{ijt-k} is the lagged values of p_{ijt} , fod_{jt} logarithm of fodder price, $rain_{jt}$ is the dummy variable which equals 1 when the six monthly cumulative rainfall in province i at month t is lower than the sample average of the cumulative rainfall in province i , y_{jt} is the logarithm of real income per capita, res_{jt} is the reserve of livestock per thousand population, and rel_{jt} is the number of students registered to Quranic lectures per thousand population, which is used as a proxy to control the effect of religiosity.² We estimate the price of ewes and rams separately by seemingly unrelated regression (SUR) and restricting the coefficient for the peak demand period (Eid dummy) as the same.

$$p_{ijt} = \beta_{1i} + \beta_{2i} Eid + \beta_{3ik} p_{ijt-k} + \beta_{4i} t + \beta_{5i} t^2 + \beta_{6i} fod_{jt} + \beta_{7i} rain_{jt} + \beta_{8i} y_{jt} + \beta_{9i} res_{jt} + \beta_{10i} rel_{jt} + \varepsilon_{ijt} \quad (3.10)$$

In order to robustly assess the adjustment of prices during the pre-Eid months, Eid month, and post-Eid months, we define 12 dummies in addition to the Eid dummy representing the six months before the Eid month and six months after the Eid month. Dummies B1Eid, B2Eid, B3Eid, B4Eid, B5Eid, and B6Eid equal 1 for the month before the Eid month to the six respective months before the Eid month, and the dummies A1Eid, A2Eid, A3Eid, A4Eid, A5Eid, and A6Eid equal 1 for the month after the Eid month to the six respective months after the Eid month.

² Prices of ewes, rams, fodder, and GDP per capita are deflated to 2003 TL with CPI. The year 2006 includes two Eid periods: one in January and the other in December, so we have 14 Eid periods in 13 years. Lag lengths of the prices of ewes and rams are determined by modelling these prices in a panel vector autoregressive framework. Modified Bayesian information criterion suggested two lags for prices of ewes and rams. We also estimated the model with one lag of the prices and the results were similar.

Since the data on monthly sheep prices are the averages of the monthly transaction prices, the effect of the excess demand shock on prices is better-manifested during the Eid periods that are closer to the end of the relevant month and less-manifested Eid periods that are closer to the beginning of the relevant month.

Table 3.7 First Days of Eid

Year	First Day	EF2	EL2
2005	Thursday, January 20		x
2006	Tuesday, January 10	x	
2006	Sunday, December 31		x
2007	Thursday, December 20		x
2008	Monday, December 8	x	
2009	Friday, November 27		x
2010	Tuesday, November 16		x
2011	Sunday, November 6	x	
2012	Thursday, October 25		x
2013	Tuesday, October 15	x	
2014	Saturday, October 4	x	
2015	Thursday, September 24		x
2016	Monday, September 12	x	
2017	Friday, September 1	x	

Accordingly, we define two additional dummies: the first excludes the Eid months during which the Eid periods start after the second Friday (*EidL2*) of the relevant month, and the second excludes the Eid months during which the Eid period starts before the second Friday of the relevant month (*EidF2*) in anticipation of the coefficient greater than the coefficient of the *Eid* dummy and the coefficient less than the coefficient of the *Eid* dummy, respectively.

As shown in table 3.7 for the *EidL2* dummy, we exclude five Eid periods in the years 2006 (Eid in January), 2008, 2011, 2014, and 2017. For the *EidF2* dummy, we exclude nine Eid periods in the years 2005, 2006 (Eid in December), 2007, 2009, 2010, 2012, 2013, 2015, and 2016.

3.4. Empirical Results

In line with the suggestion by Solon et al. (2013) for reporting both unweighted and weighted estimation results, we have two specifications for the SUR model: one is an unweighted specification and the second is the weighted specification, weighted by the square root of province populations. Estimation results are summarized in Table 3.10. The regression results in Table 3.8 show that the sheep price tends to be between 1.2% and 1.3% higher a month before the Eid month and between 1.4% and 1.5% higher during the Eid month. Then, prices constantly fall for the three consecutive months in both specifications.

The coefficients of the *EidL2* and *EidF2* dummies are in line with our prior expectations. The coefficient of the *EidL2* dummy is higher, almost double, than the coefficient of *Eid* dummy and coefficient of the *EidF2* dummy is lower (and also negative) than the *Eid* dummy. Sheep prices tend to be between 2.7% and 2.6% higher for the Eid periods closer to the end of the Eid month. The reduction of prices begins even within the Eid month, when the Eid period is closer to the beginning of the Eid month: prices tend to be 0.6% to 0.7% lower during these months. Prices rise with excess demand shock, starting with the prior month of the Eid month and falling gradually within the following months. We estimated equation 3.10 using fixed effects model as a robustness check. As presented in tables 3.9 and 3.10 results were almost same.

In sum, these results robustly show that the prices adjust in order to attain the market equilibrium. We can argue that the market mechanism with its own devices is capable of absorbing even a huge demand shock without any shortage of the commodity.

Table 3.8 SUR Model Coefficients of the Dummy Variables

Dummy	Specification 1	Specification 2
<i>B6Eid</i>	-0.002 (0.002)	-0.002 (0.002)
<i>B5Eid</i>	-0.001 (0.002)	-0.002 (0.002)
<i>B4Eid</i>	0.002 (0.002)	0.001 (0.002)
<i>B3Eid</i>	0.001 (0.002)	0.002 (0.002)
<i>B2Eid</i>	-0.001 (0.002)	-0.001 (0.002)
<i>B1Eid</i>	0.013*** (0.002)	0.012*** (0.002)
<i>Eid</i>	0.014*** (0.002)	0.015*** (0.002)
<i>EidL2</i>	0.027*** (0.002)	0.026*** (0.002)
<i>EidF2</i>	-0.007** (0.003)	-0.006* (0.003)
<i>A1Eid</i>	-0.005** (0.002)	-0.005** (0.002)
<i>A2Eid</i>	-0.008*** (0.002)	-0.008*** (0.002)
<i>A3Eid</i>	-0.011*** (0.002)	-0.013*** (0.002)
<i>A4Eid</i>	-0.001 (0.002)	0.001 (0.002)
<i>A5Eid</i>	-0.002 (0.002)	-0.002 (0.002)
<i>A6Eid</i>	-0.003 (0.002)	-0.003 (0.002)

*p<0.10 **p<0.05 ***p<0.01

Note: Standard errors are shown in parentheses. Specification 1 is an unweighted specification, and Specification 2 is the weighted specification, weighted by the square root of the province populations.

Table 3.9 Fixed Effect Model Coefficients of the Dummy Variables (Ewes)

Dummy	Specification 1	Specification 2
<i>B6Eid</i>	-0.001 (0.002)	-0.001 (0.002)
<i>B5Eid</i>	-0.001 (0.001)	-0.001 (0.001)
<i>B4Eid</i>	0.001 (0.001)	0.000 (0.001)
<i>B3Eid</i>	0.001 (0.001)	0.002 (0.001)
<i>B2Eid</i>	-0.002 (0.001)	-0.001 (0.001)
<i>B1Eid</i>	0.012*** (0.002)	0.012*** (0.002)
<i>Eid</i>	0.013*** (0.002)	0.013*** (0.002)
<i>EidL2</i>	0.025*** (0.002)	0.024*** (0.002)
<i>EidF2</i>	-0.007** (0.003)	-0.005 (0.003)
<i>A1Eid</i>	-0.005* (0.003)	-0.005* (0.003)
<i>A2Eid</i>	-0.007*** (0.002)	-0.008*** (0.002)
<i>A3Eid</i>	-0.012*** (0.002)	-0.014*** (0.002)
<i>A4Eid</i>	0.002 (0.002)	0.003 (0.002)
<i>A5Eid</i>	-0.001 (0.002)	-0.001 (0.002)
<i>A6Eid</i>	-0.001 (0.002)	-0.002 (0.002)

* p<0.10 ** p<0.05 *** p<0.01

Note: Standard errors are shown in parentheses. Specification 1 is an unweighted specification, and Specification 2 is the weighted specification, weighted by the square root of the province populations.

Table 3.10 Fixed Effect Model Coefficients of the Dummy Variables (Rams)

Dummy	Specification 1	Specification 2
<i>B6Eid</i>	-0.002 (0.002)	-0.002 (0.001)
<i>B5Eid</i>	-0.002 (0.001)	-0.002 (0.001)
<i>B4Eid</i>	0.002 (0.001)	0.001 (0.001)
<i>B3Eid</i>	0.000 (0.001)	0.001 (0.001)
<i>B2Eid</i>	-0.001 (0.001)	-0.002 (0.002)
<i>B1Eid</i>	0.011*** (0.002)	0.010*** (0.003)
<i>Eid</i>	0.014*** (0.002)	0.013*** (0.002)
<i>EidL2</i>	0.026*** (0.002)	0.027*** (0.003)
<i>EidF2</i>	-0.008** (0.003)	-0.008*** (0.003)
<i>A1Eid</i>	-0.006* (0.003)	-0.005** (0.003)
<i>A2Eid</i>	-0.007** (0.003)	-0.007*** (0.002)
<i>A3Eid</i>	-0.008*** (0.002)	-0.010*** (0.002)
<i>A4Eid</i>	-0.001 (0.003)	0.003 (0.004)
<i>A5Eid</i>	-0.002 (0.002)	-0.001 (0.002)
<i>A6Eid</i>	-0.003 (0.001)	-0.003* (0.002)

* p<0.10 ** p<0.05 *** p<0.01

Note: Standard errors are shown in parentheses. Specification 1 is an unweighted specification, and Specification 2 is the weighted specification, weighted by the square root of the province populations.

3.5. Status of Local Breed Sheep in Turkey

TIGEM identifies the production of breeding resources and protection of genetic sources among the subjects of its mission. As of 2018, it sheltered 191,827 head of sheep, which consist of 143,153 head local sheep breeds (four distinct breeds: Ivesi, Akkaraman, Morkaraman, and Kivircik) and 48,374 head of cross-breed sheep (six distinct breeds: Merino-derived cross-breed, Malya, Bafra, Acipayam, Turktahirova, and Polatli) within its nine enterprises around the country. TIGEM has an exceptional influence on the country's sheep market. In 2018, it sold 17,569 head of breeding sheep and donated 140,834 breeding sheep as a part of government support programs so that, in total, 158,403 breeding sheep were provided to the farmers that year. In the same year, the total number of breeding sheep within the country was approximately 683,279 heads.³ Consequently, almost 23% of the breeding sheep in the market is sourced from TIGEM (TIGEM, 2018). With the mission to protect genetic sources and power in the sheep market, data on the number of local sheep breeds and cross-breed sheep sheltered within TIGEM's enterprises represent a valuable source of data for our study.

³ Number of breeding sheep is approximated by subtracting number of dairy sheep and number of sheep slaughtered within the year from total number of sheep using data provided by TUIK.

Table 3.11 Number of Sheep Within the TIGEM's Enterprises

Year	Local breed	%	Cross-breed	%
2009	89,816	77.5%	26,048	22.5%
2010	77,550	75.3%	25,484	24.7%
2011	79,168	75.8%	25,259	24.2%
2012	86,936	76.6%	26,593	23.4%
2013	90,707	74.6%	30,844	25.4%
2014	106,259	73.5%	38,370	26.5%
2015	115,707	72.4%	44,104	27.6%
2016	131,809	73.6%	47,260	26.4%
2017	131,889	73.0%	48,757	27.0%
2018	143,453	74.8%	48,374	25.2%

Source: Annual Reports of TIGEM

Table 3.11 reports the number of sheep within TIGEM on a yearly basis during the last decade. The number of local breeds has risen 53,637 during the period under analysis, but their share of the total has decreased to 74.8% from 77.5%, while the share of cross-breeds has increased 2.7% from 22.5% to 25.2%. Over the nine periods between 2009-2018 annual average growth rate of the local breeds has been 5.3% and is lower than that of cross-breeds, with an annual average growth rate of 7.1%. The disadvantageous position of local breeds becomes more apparent when compared in terms of five yearly growth rates: local breeds' five yearly average growth rate, at 48.3%, is significantly lower than that of cross-breeds (69.0%).

In 2009, among 89,816 heads of local sheep breeds, 71.9% were Ivesi, and among the 26,048 cross-breed sheep, 61.7% were Merino-derived cross-breed. Table 3.12 reports the numbers and shares of these two dominant breeds for the last decade. During the decade, Merino-derived cross-breed strengthened its domination, with its share increasing both in the total number of sheep and the number of cross-breeds, while the trend for the number of Ivesi sheep has indicated the exact opposite. The share of Ivesi among total sheep decreased 5.3% (from 71.9% to 66.6%), and its share in local sheep breeds fell 6.0% (from 55.8% to 49.8%). The share of Merino-derived cross-breed among total sheep increased 8.0% (from 61.7% to 69.6%), and its share of cross-breed sheep increased 3.7% (from 13.9% to 17.6%). Over the nine periods between 2009-2018, the annual average growth rate of the Ivesi has been 4.4% – almost half that of Merino-derived cross-breed, with an annual average growth rate of 8.6%. As is the case for the total local sheep breeds, the disadvantageous position of Ivesi becomes more apparent when compared in terms of the five yearly growth rates: Merino-derived cross-breed's five yearly average growth rate, at 90.8%, is almost 2.5 times that of Ivesi (36.3%).

Comparative analysis of the trends in the number of local sheep breeds and cross-breed sheep suggest that local sheep breeds, while growing in number, has a considerably lower growth rate than that of cross-breed sheep and also the relative share in total favors to that of cross-breed sheep. These findings support the concern regarding the relationship between the free-market mechanism and the loss of genetic diversity.

Table 3.12 Number of dominant breeds in local breed and cross-breed sheep

Year	Ivesi			Merino-derived cross-breed		
	Number of heads	% in local breed	% in total	Number of heads	% in cross-breed	% in total
2009	64,610	71.9%	55.8%	16,070	61.7%	13.9%
2010	56,808	73.3%	55.1%	15,481	60.7%	15.0%
2011	58,524	73.9%	56.0%	15,367	60.8%	14.7%
2012	65,102	74.9%	57.3%	15,963	60.0%	14.1%
2013	66,687	73.5%	54.9%	19,073	61.8%	15.7%
2014	75,304	70.9%	52.1%	25,785	67.2%	17.8%
2015	76,409	66.0%	47.8%	30,549	69.3%	19.1%
2016	88,130	66.9%	49.2%	32,498	68.8%	18.1%
2017	89,390	67.8%	49.5%	33,833	69.4%	18.7%
2018	95,527	66.6%	49.8%	33,692	69.6%	17.6%

Source: Annual Reports of TIGEM

4. CONCLUDING REMARKS

Empirical studies regarding the excess demand shocks and response of the prices mainly utilize dataset on prices of items sold in retail stores and focus on behavior of retail prices during the periods of high demand such as; weekends, pre-Christmas holiday periods, post-Thanksgiving weekends and Easter shopping periods. Therefore, relevant literature is broadly concentrated on retail firms' pricing strategies. This study aims to contribute the literature on response of prices to an excess demand shock through a unique natural experiment: the demand shock to sheep prior to the Muslim sacrifice feast (Eid-al Adha). During the Eid-al Adha, massive amount of sheep sacrificed in just four days of Eid period.

The demand shock arising prior to Eid al-Adha has distinguishing features that enable empirical examination of price responses apart from a retail pricing setting. Our results robustly show that sheep price tend rise from prior month of the Eid month and the Eid month then prices constantly fall for the three consecutive months of the Eid month. Sheep price tends to be between 1.2% and 1.3% higher a month before the Eid month and between 1.4% and 1.5% higher during the Eid month.

5. DISCUSSION

From an economic standpoint, solution to the tragedy of the commons relies on well-defined property rights and competitive market mechanism for limiting individuals' self-serving, short-sighted actions that result in dramatic depletion of the common resources. Our results robustly show that the free market mechanism can cope with even a very challenging demand shock through the adjustment of prices without any shortage of the commodity. However, this finding does not guarantee that such an outcome is sustainable over the very long term. Recent events that took place within the South African countries provide a significant example regarding the efficiency of this solution. South African countries succeeded in overturning the plight of the African elephant and achieved gains in the elephant population by devolving ownership of the elephants to the landowners. This experience proved the efficiency

of enabling individuals to benefit economically from the use values and non-use values of a resource in encouraging them to conserve the resource and in constraining them from overexploitation of the resource for short-term gains without considering long-term costs.

While the private property rights and market mechanism proved efficient in alleviating the tragedy of the commons, this solution, if neglected, may pose a serious threat. During recent decades, deterioration of genetic diversity has reached alarming levels. Even mammals such as cattle, sheep, and goats, which have been domesticated for thousands of years and have long been subject to market mechanism, are facing the risk of extinction. Dramatic loss of genetic diversity among cattle and sheep is mainly attributed to escalating economic pressures that oblige farmers to shift from local breeds towards more profitable and more productive industrial breeds. This adverse impact calls for review of the sustainability of outcomes produced by the free-market mechanism.

The empirical results of the study that are based on a unique natural experiment, in which a huge demand shock to sheep arises, robustly show that the competitive free-market mechanism with well-defined property rights is capable of coping with even a very challenging demand shock through adjustment of prices without any shortage of the commodity. However, this finding does not guarantee that such an outcome is sustainable over the very long term. Comparative analysis of the growth rate of the local breed of sheep and cross-breed sheep population showed that the growth rate of the population is overwhelmingly in favor of cross-breed sheep, thus supporting the concern for a free-market mechanism that intrinsically causes the extinction of local sheep breeds, which represent an invaluable genetic resource.

6. LIMITATIONS AND FUTURE RESEARCH

The aim of this research is twofold. First, it seeks to analyze equalizing forces of demand and supply via the adjustment of prices to assess the efficiency of the market mechanism in handling a huge demand shock by employing a unique natural experiment: the demand shock to sheep prior to the Islamic festival of sacrifice (Eid

al-Adha). Second, it seek to investigate the consequence of the local breed population of the sheep in comparison with the cross-breed population during the last decade by evaluating data on the number of sheep hosted in Turkey's General Directorate of Agricultural Enterprises which is a dominant institution in providing breeding animals to the country's farmers.

Analysis of the consequence of local breed sheep in comparison with cross-breed sheep is based on the descriptive data of the types of breeds of sheep hosted within the TIGEM's enterprises. However, an empirical analysis based on data from a field study representative of country's sheep population would be a better indicator of the trend of local breed sheep population with respect to cross-breed sheep population. Therefore, empirical investigation of the status of the local breed sheep population using a representative sample data remain as future research subject.

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APPENDIX

Appendix A: Additional Tables

Table A.1 Reserve of Ewes per Thousand Population Highest and Lowest 10 Provinces

#	Province	Reserve
Highest 10		
1	Tunceli	1904.30
2	Igdir	1328.90
3	Agri	1245.54
4	Mus	1044.34
5	Van	1002.65
6	Hakkari	881.13
7	Bitlis	769.20
8	Bingol	763.15
9	Karaman	698.36
10	Nigde	656.11
Lowest 10		
1	Yalova	35.24
2	Hatay	28.62
3	Sakarya	17.04
4	Karabuk	16.31
5	Duzce	14.58
6	Kocaeli	12.79
7	Bartin	9.16
8	Zonguldak	8.76

9	Rize	7.55
10	Istanbul	2.91

Table A.2 Reserve of Rams per Thousand Population Highest and Lowest 10 Provinces

#	Province	Reserve
Highest 10		
1	Tunceli	122.59
2	Kars	94.93
3	Mus	77.57
4	Hakkari	72.42
5	Igdir	68.73
6	Bitlis	60.52
7	Van	60.35
8	Agri	57.74
9	Erzincan	50.10
10	Karaman	46.83
Lowest 10		
1	Hatay	2.56
2	Sakarya	2.32
3	Yalova	2.21
4	Karabuk	1.57
5	Zonguldak	1.36
6	Kocaeli	1.36
7	Rize	1.27
8	Duzce	0.75
9	Bartın	0.64
10	Istanbul	0.18

Table A.3 Median CPI Values of 26 Regions

#	Region Name	Region Code	CPI
1	Ankara	TR51	195.22
2	Ağrı, Kars, Iğdır, Ardahan	TRA2	194.88
3	Balıkesir, Çanakkale	TR22	194.53
4	Kayseri, Sivas, Yozgat	TR72	193.81
5	Kocaeli, Sakarya, Düzce, Bolu, Yalova	TR42	193.29
6	Van, Muş, Bitlis, Hakkari	TRB2	192.68
7	Erzurum, Erzincan, Bayburt	TRA1	192.35
8	Aydın, Denizli, Muğla	TR32	191.39
9	Adana, Mersin	TR62	191.30
10	İstanbul	TR10	190.82
11	Konya, Karaman	TR52	190.49
12	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir	TR71	190.07
13	Bursa, Eskişehir, Bilecik	TR41	189.74
14	Şanlıurfa, Diyarbakır	TRC2	189.74
15	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	TR90	189.72
16	İzmir	TR31	189.35
17	Tekirdağ, Edirne, Kırklareli	TR21	188.60
18	Hatay, Kahramanmaraş, Osmaniye	TR63	188.51
19	Samsun, Tokat, Çorum, Amasya	TR83	188.24
20	Malatya, Elazığ, Bingöl, Tunceli	TRB1	187.06
21	Gaziantep, Adıyaman, Kilis	TRC1	186.82
22	Manisa, Afyonkarahisar, Kütahya, Uşak	TR33	186.74
23	Kastamonu, Çankırı, Sinop	TR82	186.12
24	Zonguldak, Karabük, Bartın	TR81	185.66
25	Antalya, Isparta, Burdur	TR61	185.49
26	Mardin, Batman, Şırnak, Siirt	TRC3	177.20