A Threat to Food Price Stability in Turkey

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The volatility of meat prices affects the accessibility and even food security of some consumers in Turkey. The prices of selected livestock and a major feed component, wheat, as well as the exchange rate of the domestic currency in Turkey because imports augmented the domestic live calf and sheep supply. The analysis applies 470 price observations from January 2005 to October 2019 for each of the following price series: live calf, live sheep, feed wheat, and exchange rate of Turkish lira to US dollar.

Keywords: food security ; live calf ; live sheep ; feed wheat ; exchange rate ; volatility

1. Introduction

The amount of meat consumption per capita is regarded as an important indicator in determining a country's development and welfare levels ^{[1][2]}. Animal products are the preferred data points as they are primary protein sources. Red meat rich in protein is still an important food source in developing countries ^{[3][4]}. The data of the World Health Organization (WHO) suggests that a healthy individual should consume 1 g of protein for each kilogram of body weight per day, and about 42% should be of animal origin. In 2017, annual per capita red meat consumption in Turkey was 12.5 kg (8.3 kg of beef, 4.1 kg of mutton, and 0.1 kg of pork), of which approximately 67% was beef, whereas the per capita consumption amounts in EU-28 countries and the United States in the same year were 45.4 kg (11 kg beef, 1.9 kg mutton and 32.5 kg pork) and 49.8 kg (25.8 kg of beef, 0.4 kg of mutton, and 23.6 kg of pork), respectively ^[5].

Surges in beef prices have an important effect on consumption, and red meat price fluctuations have occurred over time in Turkey. Whereas the average global beef price was \$2.98, \$3.35, and \$4.98 in 2005, 2010, and 2016, respectively, the price in Turkey was \$8.59, \$16.04, and \$12.72, in the same years ^[5]. The swings in red meat prices result from an input cost increase ^[2]. Feed costs comprise more than 60% of total livestock production costs ^[6]. Feed costs constitute 30% of the costs of cattle finishing in Turkey ^[Z]. Therefore, an increase in the prices of grains increases livestock prices. Variations in feed prices in the cattle supply chain directly affect the costs and profitability of raising cattle ^{[B][9]}.

Excessive price surges in agricultural products adversely influence food security, economic growth, and social stability, and disproportionately affect the poor $\frac{100[11](121[13])}{120[13]}$. The food crisis in 2008 and the resulting social unrest exemplify the consequences of such price fluctuations in emerging economies $\frac{140}{1}$. According to the United Nations Food and Agriculture Organization (FAO), the general food price index increased by 27% in 2007 and 25% in 2008, and the international prices of staple food products reached their highest level over the past three decades in June 2008 $\frac{1150}{100}$. An estimated 115 million people have become chronically food insecure $\frac{1150}{100}$. The volatility in global food prices contributed to the socio-political unrest in the Middle East in 2011 $\frac{1100}{100}$ because many countries in the region depend on food imports. The surges in food prices have been expected to continue $\frac{1120}{100}$. For example, commodity prices increased in the latter part of 2016 $\frac{1180}{100}$. Grain, red meat, and chicken prices increased in Iran by 17.5%, 12.7%, and 13.6%, respectively in 2017 $\frac{1100}{100}$. In Turkey, beef, and lamb prices increased by 10.28% and 22.86%, respectively, during the 12 months from November 2017 to October 2018 $\frac{120}{100}$. Their price levels reached historical records of 33 Turkish Lira (t) and t46 per kg, respectively, in July 2017. Easing import regulations caused meat prices to fall slightly. However, the effect was short-term because of feed price increases. Inadequate domestic forage crop production requires imported corn and soy causing higher animal feeding costs in Turkey than in other countries. As a result, Turkey's animal product prices are vulnerable to fluctuation, compromising domestic food security and the nutritional needs of its population.

An understanding of the long-term integration of input markets with the livestock sector is needed for the development of food security policies in Turkey. In Turkey, 2.5% of the population has been reported as being food insecure, a level which has remained stable for several years ^[20]. Population segments vulnerable to food insecurity included landless rural residents, smallholder farmers, and women caring for families ^[21]. Affordability was the primary reason for food insecurity and nationwide nutrition surveys were deemed necessary to fully understand the scope of the problem ^[22]. Of particular concern has been the access and affordability of meat and its direct relation to household food security ^[23]. A recent study

of a small sample of health center visitors, applying the Household Food Security Survey developed by USDA, reported a relatively high ratio of food-insecure families, while Bucak, et al. ^[24] suggested the persistence of the problem and called for a more complete study. Keskin and Demirbaş ^[25] argued for the use of a modified food security measurement method due to the multidimensionality of the problem specifically fitting the conditions in Turkey.

Instability (and even volatility) of food prices is one of the facets of food insecurity and has been a major concern for food security in Turkey ^{[22][26]}. Policy decisions supporting a stable supply of animal protein benefit from uncovering the presence and causality of short- and long-term uncertainty pass-through between livestock and feed markets. This study explores the causality between live cattle, live sheep, and feed wheat markets, as well as the effects of short-and long-term permanent fluctuations among their price series. Additionally, consider the effects of the exchange rate and import decisions and their influence on causality and transmission across the explored agricultural markets. Uncertainty and asymmetrical spillovers among agricultural products are highly likely to be penetrated in a developing country like Turkey, whose economic structure is constantly fragile due to climate change, water shortage pressure, high food inflation, bottlenecks in the food supply chain, depreciation of the local currency, income inequality, political instability, etc. It is, therefore, crucial for policymakers and industry stakeholders to embody such levels of risk by investigating the volatility pass-through between agricultural markets in a major developing country where food security depends on imported animal feed. Results, therefore, provide insights applicable to shaping domestic policies guiding livestock farmers, feedlot operators, and food marketers to secure the domestic food supply.

2. Volatility in Live Calf, Live Sheep, and Feed Wheat Return Markets

The high volatility of agricultural product prices in the 2000s sparked a debate on the driving forces of food price instability. Studies demonstrated that the extreme volatility in agricultural product prices is dynamic and caused by many interrelated factors.

Turkey is a net importer of agricultural products and is directly affected by fluctuations in the US dollar exchange rate. The exchange rate variation causes food price volatility [19][27][28][29]. In recent years, the increase in corn- and soy-based biofuel production [30][31] affected feed prices, a basic input in animal husbandry [32]. The short-term depreciation of the Turkish lira has significantly affected wheat prices [33]. As noted by Salisu and Ayinde [34], the negative effects of continued volatility or uncertainty in exchange rates on the macroeconomic and domestic markets are inevitable and act as a barrier to an adequate food supply. This effect is even more pronounced in a developing country with a fragile economic structure. Abbott and Borot de Battisti [35] who investigated the silent drivers behind rising food prices in the world market, attributed this causality to factors such as insufficient investment in agriculture, increased international oil prices, and depreciation in the exchange rate, and Yan, et al. [36] listed distance and sales volume as price determinants. On the other hand, Birthal, et al. [37] found production shocks, seasonality in production and market entries, domestic trade, export policies, and market power of intermediaries as factors responsible for the volatility of onion prices in India. Mitchell [38] researched the effects of the exchange rate on food prices and estimated a 20% increase as a result of the rate depreciation. In contrast, Reboredo and Ugando [39] used copulas methods to examine the relationship between the US dollar exchange rate and the international prices of several agricultural commodities (corn, soybean, wheat, and rice) without their excessive market dependencies. A positive but weak dependence on the food exchange rate confirmed that the price spikes for those commodities were not due to excessive US dollar depreciation. Still, Mawejje and Nampewo [40] found that the large quantities and diversity of non-tradable staple foods in Uganda moderated the full transferability of global prices to domestic market prices, even though Ugandan local food prices adjusted to both exchange rate movements and international food prices. Similarly, in a study conducted in Nigeria, Akanni [41] found evidence that the directional interdependence between food prices and exchange rates is taken into account, based on the obtained diffusion indices. Moreover, after the collapse of the exchange rate, food prices tend to reflect the exchange rate returns and volatility. In an earlier study conducted in Turkey, it was emphasized that there was a causality relationship between the exchange rate of US dollars and goat meat price [42]. Urak, et al. [43] reported that long-term persistent uncertainties in wheat and exchange rate markets in Turkey create permanent uncertainty for all markets, including their own.

Price uncertainty especially influences beef because of the long biological production cycle. Price volatility is considered a major risk in production decisions and affects future prices ^[44]. Knowledge of price volatility can protect profitability by allowing risk management. Similarly, when information about price volatility spillover effects and implemented countermeasures is provided, policymakers can design solutions ^{[45][46][47]} and ensure food security.

Studies on fluctuations in livestock or meat prices are limited. Kesavan, et al. ^[48] stressed that in the United States, the volatility in beef and pork farm prices depends on the information obtained from previous periods. Piotr and Witold ^[49] have suggested, for example, that there are strong nonlinear relationships between live cattle and pork price returns and

corn and wheat price returns. Luo and Liu [50] used various generalized autoregressive conditional heteroskedasticity (GARCH) models (i.e., such as the GARCH, MV-GARCH, T-ARCH, and E-GARCH techniques) in their study covering the period between January 2000 and December 2007 to demonstrate meat price volatility in China. The results concluded that beef is high-risk but low-return, and beef, sheep, and poultry prices show asymmetric price volatility, with volatility due to price decreases being lower than volatility due to price increases. Khiyavi, et al. [51] reported that the volatility in agricultural input and retail food prices showed significant and positive spillover effects on the volatility of agricultural output prices. It has also been reported that feeder cattle prices caused volatility in live cattle prices, but the volatility in live cattle prices did not affect feeder cattle prices [8][52]. A study of the substitute goods effect between red meat prices stated that the shock in one market created fluctuation in prices of another market [53]. In a study investigating the effect of the exchange rate on the volatility of meat-type prices, Miljkovic and Zhuang [54] investigated the spread of the exchange rate on Japanese meat import prices and found that there is a partial transmission of the exchange rate to meat and poultry import prices. However, among the rare studies examining short-run shock and volatility spillovers among the world's four major agricultural commodities, Lahiani, et al. [55] found the existence of both concurrent shock and long-term volatility spillover transmission among commodities by using the model of Ling and McAleer [56]. Interestingly, wholesale and retail meat prices were rising, whereas livestock prices were falling [57], increasing the farm-to-wholesale marketing margin, which is often casually defined as the difference between the farm-level price for livestock and wholesale meat prices. Meanwhile, Abdallah, et al. [58], in their study in Finland, found an interesting result wherein the vertical price passthrough for the pork market is reversed. In other words, the volatility was transmitted from consumer price spikes to producer price uncertainty in the pork market. Adeosun, et al. [59] emphasized that oil price shocks create upward pressure on food prices during periods of high inflation. Similarly, Tosun and Demirbas [60], in their study of 71 meat producers in Turkey, emphasized that the fluctuations in the prices of intermediate goods used in meat production negatively affected the prospective production plans of the producers. There are few studies on the supply chain of beef and dairy sectors in Turkey, but several of them are worth mentioning [61][62][63].

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