Do livestock supports increase livestock production? Province based Panel ARDL analysis for Turkey example

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Abstract

In recent years, there has been a significant change in Turkey's agricultural support policies, especially on livestock supports. The livestock support, with a share less than 5% in total has in early 2000s has reached up to 35% at the end of 2020. In order to understand the impact of increase in livestock supports, 11 years of livestock support and livestock presence in 81 provinces in Turkey were analyzed via Panel ARDL method. The results of the analysis revealed that support to livestock does not affect the number of livestock in the short term, but has a positive effect in the long run. Furthermore, both in the short and long term, the increase in prices in the livestock sector increases the livestock fund. Even though increases in feed prices harm livestock presence in short run as expected, this negative effect disappears in the long run. The production effect of minimum wage variable is added to the model considering the unique situation of Turkey, which effects the production negative in the short run, but positive in the long run.

Keywords*: Livestock supports, Production effects of the livestock supports, Feed price minimum wage, Panel ARDL.*

1. Introduction

Agricultural supports are one of the most controversial issues of international trade. The primary cause of this situation is the distorting effects of agricultural supports on production and trade. Surpluses in the agricultural production causes a decline in prices which results in global imbalances and ineffective use of resources. This situation has a great impact on economies dependent on agriculture. For this reason, agricultural supports were introduced for the first time in 1987 during the OECD Ministerial Committee and member states has made a commitment to minimize distorting effects of these supports (OECD, 2000, p. 6). First ever official attempt to regulate agricultural supports was made by World Trade Organization (WTO).

WTO, considering the distorting side of agricultural supports has agreed to reduce coupled payments related to production level, namely "amber box" supports issuing Agreement on Agriculture at the end of Uruguay round in 1994.[1] Yet, underdeveloped countries were exempt-

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[1] Starting in 1995, developed countries agreed to cut decoupled payments in this context by 20% within 6 years, and developing countries including Turkey by 13% within 10 years.

ed from making any cuts. In addition, member states were not subjected to any limitations on decoupled payments categorized as "green box" supports which have no or minimal impact on production and trade. Another category that WTO member states have agreed on is "blue box" supports. Blue box supports reduce the production effect relatively via limiting the production itself. On the other hand, blue box payments are given without any limitations and reduction commitments if they are made on fixed areas and fixed yield or a fixed number of livestock (WTO, 2016, pp. 18-22).

Following the signing of Agreement on Agriculture (1994), an important transformation process in agricultural supports has begun. Many countries, especially developed ones, have shifted their policy towards agricultural supports, which are thought to be ineffective on production and trade. For instance, market price supports coupled with the production was repealed in the United States of America (USA) with the 1996 Farm Bill, and Production Flexibility Contract Payments were implemented as replacement, whereas the European Union (EU) has mostly abandoned market price supports in order to implement direct payments in 1992 with the Mac Sharry Reforms. Turkey has stepped into this transformation process with introduction of direct income supports in 2000 (Baffes and Gorter, 2005, pp. 79-86).

Agricultural supports carry an utmost importance in Turkey in many aspects. Agricultural sector constitutes approximately 20% of the total employment according to 2020 data. Nearly 7% of Gross Domestic Product (GDP) is coming from the agricultural sector. In view of these facts, it can be stated that Turkey is among the highest agricultural support providing countries in comparison to its GDP. Indeed, according to OECD, the ratio of agricultural supports to GDP in Turkey in 2020 is 1.61%. In scope of agricultural supports, livestock support is also an outstanding issue in Turkey. To be more precise, while livestock support accounted only for 5% of a total of 1.8 billion Turkish Liras (TL) agricultural support in 2002; this ratio has increased up to 35% of a 21.8 billion TL agricultural support in 2020. Of this livestock support, approximately 45%, %20, %12 and %10 is directed to calf support, milk support, input support and sheep/goat support respectively.

A significant part of the livestock support targets cattle (indigenous, cultural, and crossbreed races), buffalo, sheep (merino, indigenous and other races) and goat (angora goat, hair goat, other races) breeding. So called supports are given in accordance with the number of head, therefore it is not possible to foresee a concrete number. In other words, there is not a fixed total amount for support provided in the field of livestock in Turkey. This is where production effect of livestock support comes in. In line with this fact, livestock presence is high when the amount of support has been high. According to 2002 data, the number of cattle, buffalo, sheep, and goat has been 41.8 million, where this number has increased up to 76.3 million in 2020.[2]

There is a variety for reasons of increase in livestock supports in Turkey. First of all, the livestock sector plays an important role in Turkey's agricultural production. According to FAO, in 2018, the livestock sector has accounted for 37% of agricultural production in Turkey. Furthermore, according to the Turk Stat's "Agricultural Enterprise Structure Research" conducted in 2016, livestock husbandry accounts for 63% of all agricultural enterprises in Turkey.[3] Moreover, supply gap in the meat sector constitutes another aspect of this issue (Eroğlu *et al.*, 2020: 117). These important reasons for agricultural supports also lead to discussions about the production effect of agricultural support in Turkey. Therefore, project-based rural development supports which is decoupled from production has started recently in Turkey (Ün, 2020, pp. 337-342).

Government support for livestock in Turkey has increased about 85 times in 18 years and

[2] Turk Stat.

[3] According to the Agricultural Enterprise Structure Research in 2016, 37.2% of the agricultural enterprises in Turkey are engaged in plant production. While 62.3% of the remaining agricultural enterprises are engaged in plant production and livestock husbandry together, 0.5% are engaged in livestock husbandry activities.

reached 35% of the total budget to support agriculture between 2002 and 2020.[4] On the other hand, approximately half of the workforce in Turkey earns minimum wage. That is why, it is inevitable that changes in minimum wage dramatically effect livestock sector since minimum wage is a significant cost item for producers. Moreover, minimum wage can also have a bearing on labor shifts between sectors and thus level of production. Due to these reasons; important indicators affecting livestock sector such as livestock support, livestock price, feed price and minimum wage are worth inquiry.

This study dealing with the production effect of livestock supports, offers different contributions to the literature. Firstly, the study, covering 81 regions in Turkey, offers a broad perspective on the subject. Secondly, the effect of feed and livestock prices on the livestock sector is demonstrated, as an important discussion topic in Turkey. Thirdly, the effects of changes in minimum wage on the livestock sector is discussed, taking Turkey's unique situation into account. Moreover, this paper provides remarkable contributions to the body of literature via its findings on the basis of Turkey example. Above all, insisting on production under threat of increasing input costs and various attitudes of agribusinesses against changes in minimum wages in the short and the long run provides different views both for researchers and policymakers.

2. Literature review

Agricultural support is an important source of income for producers. Even if reforms on income diversification for producers plays a diminishing role for dependence on supports (Lipshits and Barel-Shaked, 2021), these supports are still an important indicator for agribusinesses. At the same time, these supports are as crucial as mechanization, specialization and innovative technologies for increasing production and efficiency (Dhraief *et al.*, 2019). In addition, production effect of agricultural support is essential not only for agricultural policy but also its effects on international trade. Therefore, vast majority of studies focus on production effect of agricultural supports.

In one of the studies that examine this topic, Adams *et al.* (2001) showed that PFC (Production Flexibility Contract) and MLA (Market Loss Assistance) payments increase production in the USA. Goetz *et al.* (2003) concluded that direct supports implemented in Switzerland positively affect production. In addition, it has been revealed that indirect supports provided to producers such as tax reductions are also effective on production. O'Donoghue and Whitaker (2010) indicated the effects of direct supports in the USA on crop and livestock production. Weber and Key (2012) and Becker and Judge (2014) have also reached similar results, concluding that direct supports given in the USA have a positive effect on crop production. Tong *et al.* (2019) conducted another study on foreign trade impact of agricultural supports. They concluded that each 1% decrease in agricultural supports reduced the export of agricultural products approximately by 0.40% between 1999 and 2011 in the USA.

Some studies on the production effect of agricultural supports have been conducted on the Common Agricultural Policy (CAP) of the EU. Frandsen *et al.* (2003) analyzed the implications for crop and livestock production in case of the complete abolition of agricultural supports in the EU. Results showed that if agricultural supports are completely removed, the crop production will decrease between 5% and 60%, and the livestock production will decrease between 4% and 11%. Katranidis and Kotakou (2008) conducted another study on the impact of CAP reforms on cotton production in Greece. The findings of this study show that decoupled payments increased cotton production, but this effect diminished with CAP reforms.

Garrone *et al.* (2019) examined the effect of the CAP supports on agricultural labor productivity. According to the study, decoupled supports increase labor productivity while coupled supports slow down the increase in productivity

[4] Livestock support, which was approximately 90 million TL in 2002, increased to 7.7 billion TL in 2020.

between 2004 and 2014. In other words, even if decoupled supports do not directly affect production, they have the potential to affect production through increased labor productivity. Another study on the impact of agricultural supports concentrated on the effects of reducing decoupled payments by 40%-50% in developed countries. The findings of this study also indicated that, decreasing decoupled payments reduces agricultural production in developed countries by 5% while increasing agricultural product exports in developing countries by 12% (Banga, 2016).

Although the majority of the studies on the production effect of agricultural supports have concluded that agricultural supports affect production, there are some studies which have found no significant relationship between agricultural supports and production. Beckman and Wailes (2005) demonstrated that there was no statistically significant relationship between direct support and production in the USA between 2002 and 2004. Goodwin and Mishra (2006) concluded that there is no statistically significant relationship between the AMTA (Agricultural Market Transition Act) supports and planted area of wheat and MLA supports and planted area of corn in the USA.

Some of the studies focused directly on the production effect of livestock supports. For example Olagunju *et al.* (2020) showed that the CAP reforms made in 2005 had a positive impact on the livestock sector in Northern Ireland. Accordingly, every 1% increase in agricultural supports increase milk supply by 0.41%-1.28%, cattle stock by 0.12%-0.14%, sheep and goats stock by 0.23%-0.26%. Lehtonen and Niemi (2018), concluded that 20% reduction in agricultural supports provided to Finnish farmers as of 2021 will reduce producer incomes in the livestock sector by 20-25%. In other words, the producers in the livestock sector in Finland are largely dependent on agricultural supports. Barnes *et al.* (2016) conducted another study to investigate the impact of agricultural supports on livestock sector in Scotland. The impact of previous CAP reforms on producers' decisions was investigated in a study based on a survey of 1,764 farmers. As a result of the study, approximately half of the participants stated that they would reduce livestock activities in terms of size and intensity if agricultural supports were reduced.

Some studies investigated the effect of agricultural supports on livestock presence by controlling the number of livestock. For instance, an important study was conducted with 701 farmers in 2018 in the Tibetan Plateau of China. Main goal of this study was to reveal the effects of Grassland Ecological Protection Award Policy Supports which aims to protect grasslands, meadows, and pastures by controlling the number of livestock. At the end of the study, it was found that the supports mitigated the number of livestock in small farms whereas amplified them in large farms (Yu *et al.*, 2021). A similar study was carried out by Byrne *et al.* (2020) with 187 farmers in the Inner Mongolia Region of China between 2012 and 2014. As a result of the research, it was determined that there is a positive relationship between the support and the number of livestock. This positive relationship was attributed to the support provided to keep the number of livestock under control could not compensate for the income that the farmers would give up.

The results of the studies on agricultural supports in Turkey show similarities with other studies. Canbay (2021) demonstrated that the agricultural supports provided between 1995 and 2018 expanded crop production. Demirdöğen *et al.* (2016) concluded that input supports have a positive effect on production more than deficiency payments. Işık and Bilgin (2016), who discussed the production effect of market price supports and direct supports, concluded that both of supports increased production level. As a result of the causality analysis of the production effect of agricultural supports applied in Turkey, Yıldız (2017), Doğan *et al.* (2018), Koç and İşlek (2020), and Sağdıç and Çakmak (2021) reached similar conclusions and demonstrated that there is a particularly long-run positive relationship between agricultural supports and production.

Some studies on the production effect of agricultural supports applied in Turkey have also focused on livestock supports. The data collected from 171 farmers in Samsun province were analyzed by Eroğlu *et al.* (2020). They have revealed that livestock support payments increase the supply of beef. Erdal *et al.* (2020) debated the results of livestock supports by applying a survey on 478 livestock enterprises. According

to the findings of the study, livestock supports are an important factor for 65% of livestock enterprises in order to increase their livestock presence. Furthermore, large agribusinesses benefit more from supports. As a result of the causality analysis conducted by Erdal *et al.* (2021) for the relationship between livestock presence and livestock supports for 26 regions in Turkey, a relationship was estimated between both variables in the short and long run. In the short run, there was no significant relationship between feed supports and livestock presence, and in the long run, there was no significant relationship between milk supports and livestock presence.

The majority of studies on the effects of agricultural supports focus on crop production, mainly arguing that there is a positive correlation in between. Even though there is limited research, the same results apply for livestock supports as well.

3. Model, data and empirical findings

3.1. *Model*

The model is given in Equation (1) by taking into account the related economic theory and special cases of Turkey's economy.

$$LLN_{it} = \beta_0 + \beta_1 LSP_{it} + \beta_2 LFP_{it} + \beta_3 LLSP_{it} + \beta_4 LMW_{it} + \varepsilon_{it} \quad (1)$$

In equation 1, LLN_{it}[5] is the dependent variable indicating total the number of livestock. LSP_{it} is livestock payments made for the livestock sector. LFP_{it} is the livestock feed prices one of the fundamental indicators of input costs. $LLSP_{it}$ and LMW_{it} are the livestock prices and minimum wage for Turkey. Sub-indices of i show cities[6] of Turkey and sub-indices of t show time series which are yearly frequented in our paper. We have 891 observations in total (81∗11=891) in our data set including 81 cross-sections and 11-time series. ε_{it} represents the error terms assumed zero means, constant variance, identically and independently distributed.

Livestock payments, LSP, which constitute the main motivation of the article, are expected to increase the number of livestock. Hence, the sign of the β_1 is expected to be positive. The impact of increasing feed prices, LSP, on livestock numbers is anticipated as unfavorable because livestock feed is a crucial and perpetual input cost for the livestock sector. The impact of the increase in animal feed prices, LSP on the number of livestock is usually unfavorable, given that feed is a key and constant cost of input for the livestock sector. So, the sign of the 2 coefficient expected to be negative. Entrepreneurs engaged in livestock husbandry receive the return of their investments and efforts from the livestock products that they obtain from their livestock and by selling the livestock they raise. Therefore, the rising of livestock prices encourages them to amplify their production. In this case, the β_3 sign would be positive.

As emphasized before, we take into consideration special cases of Turkey's economy which is the second main motivation of this paper. The minimum wage is one of the most important macroeconomic variables for the Turkish economy, followed by both workers and employers. Announcement related to minimum wage is done twice a year by the government. According to the 2014 data of the Presidency of the Social Security Institution of Turkey, 41% of the employees work for minimum wages, and this rate is very high when it is compared to the average of EU countries which is approximately 7%. Considering the possible sectoral risks in the livestock sector and the sunk costs that entrepreneurs have to bear, employees would choose to work in other sectors for minimum wage by adopting risk-averse behavior if they find minimum wage y is satisfactory. On the other hand, increasing of minimum wage would cause hesitation in employers to get more employees. In sectors working with low-profit margins, employers may even choose to lay off workers in order to reduce costs. In summary, the sign of β_4 would be in either way.

[5] The L operators in the equation mean that the variables are in logarithmic form.
[6] Turkey has total of 81 cities.

3.2. *Data*

The yearly data set for 81 cities covers the 2010-2020 period. The number of livestock and support payments made for livestock sector by province data are realized by dividing them into Turkey's per capita total GDP[7] and 2003=100 based domestic producer price index. Livestock feed prices data are transformed to real ones by dividing 2003=100 basis prepared feed domestic producer price index. Livestock prices and minimum wage data are realized by dividing 2003=100 based total domestic producer price index and consumer prices index respectively.

The number of livestock by province, livestock prices, per capita GDP, 2003=100 based total and prepared livestock feed domestic producer price indexes and consumer prices index data are taken from the Turk Stat database. Livestock feed prices are provided from the Turkish Feed Manufacturers Association. Support payments by province data are provided from the Republic of Turkey Ministry of Agriculture and Forestry. Minimum wage data are taken from the Republic of Turkey Ministry of Labor and Social Security website. Empirical analyses are performed with the logarithmic form of variables.

3.3. *Empirical findings*

Before summarizing the empirical results of the paper, descriptive statistics of variables are reported in Table 1. Table 1 indicates that variables, which are the total number of livestock, and livestock supports varying in both time dimension and cross-sectional dimension have bigger standard deviations more than variables varying only in the time dimension, which are livestock feed price, livestock price, and minimum wage.

The panel ARDL approach is applicable if stationarity and cointegration conditions hold. The stationarity condition is meet when the dependent variable is I(1) and independent variables are I(0) or I(1). Cointegration condition means the existence of cointegration between variables. Therefore, we tested the stationary of variables and we checked the presence of cointegration. After we observed that necessary conditions are satisfied, we estimated our model via the panel ARDL approach (Khan *et al.*, 2020).

Before estimating the model, the stationarity of variables has to be satisfied (Ahlfeldt *et al.*, 2014; Juodis, 2018; Salim *et al.*, 2019). Two groups of unit root tests can be applied according to the presence of cross-section dependency (Baltagi, 2005; Barbieri, 2006; Kahia *et al.*, 2016). While the first generation unit root tests (Harris and Tzavalis, 1999; Levin *et al.*, 2002; Im *et al.*, 2003; Maddala and Wu, 1999; Hadri, 2000; Choi, 2001; Breitung, 2000) assume that there is no correlation among panel members, the second generation unit root tests (O'Connell, 1998; Choi, 2002; Phillips and Sul, 2003; Chang, 2002, 2004; Pesaran, 2003; Bai and Ng, 2005; Moon and Per-

Table 1 - Descriptive statistics.

	LLN	*LSP*	*LLSP*	*LFP*	*LMW*
Mean	1.6508	2.9309	1.1547	0.4590	2.6009
Median	1.7117	2.9536	1.1507	0.4596	2.5729
Maximum	2.6270	4.0938	1.2583	0.4740	2.6946
Minimum	0.3077	1.6233	1.0356	0.4442	2.5178
Std. Dev.	0.4118	0.4474	0.0668	0.0093	0.0643
Observations	891	891	891	891	891

[7] Agriculture, forestry, and fisheries GDP could also be used in that realization process, however, this data is publishing one year delay and for the 2010-2019 period the correlation coefficient between agriculture, forestry, and fisheries GDP and per capita GDP is approximately 98%. That is why we decided to use the per capita GDP series.

Table 2 - First generation panel unit root results.

	LLC	*IPS*	*ADF*	*PP*
LFP	-13.3934***	-4.4875***	209.1560***	317.9170***
ΔLFP	-14.5188***	-8.2967***	363.3260***	307.3210***
LLSP	-28.6676***	-17.2143***	624.1870***	146.7010
ΔLLSP	-7.1255***	-4.5280***	244.6570***	215.6530***
LMW	-2.7051***	8.6630	26.2140	8.2487
ΔLMW	-24.9978***	-10.4100***	431.9490***	968.4760***

*Notes: *,** and *** represent 10%, 5% and 1% significance levels, respectively. Δ operator corresponds to the difference operator. L operator shows logarithmic form. Panel unit root equations contain the constant term from deterministic components.*

ron, 2008; Pesaran, 2007) take into consideration cross-section dependency.

At this stage cross section dependencies are tested to decide whether first generation or second generation panel unit root tests will be applied. For testing cross section dependency, Breusch and Pagan (1980) CDLM1, Pesaran *et al.* (2008) CDLM (Bias-corrected scale LM), Pesaran (2004) CDLM and CDLM2 tests are applied. However, the variables of livestock feed prices *LFP*, livestock pricesand *LLSP* minimum wage *LMW* are varying only in the time dimension that is why cross section dependency is not tested for these variables directly first generation unit root tests are applied to investigate the level of stationary.

Table 2 pictures first generation panel unit root test outputs. Livestock feed prices and livestock prices are level stationary (I(0)), the minimum wage is first differenced stationary (I(1)). To check the stationarity of total livestock number and livestock payments series, we applied Pesaran's (2007) second generation panel unit root test since they contain cross sectional dependence (see Table 3). Livestock number and livestock payments series are first differenced stationary, I(1), with respect to Pesaran's (2007) panel unit root test as reported in Table 4.

As emphasized earlier variables must have cointegration relationships to be performed Panel ARDL approach. Kao cointegration test (Kao, 1999) reported in Table 5, and most of Pedroni cointegration tests (Pedroni, 1999; 2000) report-

Table 3 - Cross sectional dependency tests results.

	LLN		*LSP*	
	Stat.	*p-value*	*Stat.*	*p-value*
Breusch-Pagan LM Test	27612.0700	0.00	13823.1000	0.00
Pesaran scaled LM Test	302.7645	0.00	131.4696	0.00
Bias-corrected scaled LM Test	298.7145	0.00	127.4196	0.00
Pesaran (2004) Test	164.1275	0.00	99.2441	0.00

Note: The test statistics have a chi squared (χ^2) distribution with 3240 degrees of freedom.

Table 4 - Second generation panel unit root results.

Variables	*Test Stat.*	*Variables*	*Test Stat.*
LLN	-2.096	ΔLLSP	-2.599 ***
LLSP	-1.942	ΔLLN	-3.303***

*Notes: Critical values are taken from Pesaran (2007); *,** and *** represent 10%, 5% and 1% significance levels, respectively.*

Table 5 - Kao cointegration test result.

	t-Stat.	*p-value*
ADF	-10.1495	0.0000
Residual variance	0.0029	
HAC variance	0.0025	

Table 6 - Pedroni cointegration test results.

Alternative hypothesis: common AR coefs. (within-dimension)				
	Stat.	p-value	Weighted Stat.	p-value
Panel v-Statistic	1.2476	0.1061	0.7501	0.2266
Panel rho-Statistic	8.6670	1.0000	8.6396	1.0000
Panel PP-Statistic	-3.0851	0.0010	-2.6618	0.0039
Panel ADF-Statistic	-3.0402	0.0012	-2.5602	0.0052
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Stat.	p-value		
Group rho-Statistic	13.0165	1.0000		
Group PP-Statistic	-7.0777	0.0000		
Group ADF-Statistic	-2.8524	0.0022		

ed in Table 6, results show that there exists cointegration relationship among variables. In brief, necessary conditions are held to predict our model via the Panel ARDL approach.

Based on Pesaran *et al.* (1999) a standard Pool Mean Group (PMG) Panel ARDL model is shown in equation 2.

$$\Delta(y_i)_t = \sum_{J=1}^{p-1} \gamma_j^i \Delta(y_i)_{t-j} + \sum_{J=0}^{q-1} \delta_j^i \Delta(X_i)_{t-j} + \Phi^i\left[(y_i)_{t-1} - \{\beta_0^i + \beta_1^i (X_j)_{t-1}\}\right] + \varepsilon_{it} \quad (2)$$

y is the dependent variable of the equation which is the total number of livestock in our case. X contains a set of independent variables which are livestock payments, livestock feed prices, livestock prices, and minimum wage in our model. γ and δ are short run coefficients of lagged dependent and independent variables respectively. β represents long run coefficients and Φ is the error correction term indicating the equilibrium speed from short run to long run.

PMG Panel ARDL results are summarized in Table 7. According to Table 7, the error correction term is -0.0233 and statistically significant at 1% level. This means approximately 0.2% of short run imbalances are eliminated in the first period. This finding indicates that the equilibrium rate of the model is quite slow. Livestock payments coefficients are positive both in the short and long run. However, the short run coefficient is statistically insignificant. Accordingly, the livestock payments made for the livestock sector have positive effects on the production level in the long run on the other hand enterprisers cannot convert these payments into production in the short run. It should be noted that production processes require long periods in the livestock sector. Hence the support payments' effects would be observed in a long time period and it can be expressed that our findings are reasonable. Coefficients of livestock feed prices, representing input costs, are negative as expected but it is statistically significant only in the short run equation. People dealing with the livestock sector would prefer to stay in the sector due to limited opportunities in the Turkey market even if livestock feed prices rise. In other words, traders keep producing by taking into account the reduction in profit in the face of increasing input costs since they do not have any other options. Livestock prices' coefficients are significantly positive. Consistent with expectations, rising livestock prices increase the total number of livestock.

For the effect of minimum wage on the livestock sector, we got interesting findings. In the short run, the negative and significant coefficient is observed whereas in the long run and positive and significant coefficient is taken. Actually, obtained results related to minimum wage are logical considering the general economic structure of Turkey. Labor forces adopting a risk-averse attitude would hesitate to enter the livestock sector when the minimum wage is relatively satisfactory. Because livestock sector contains a lot of risks and it needs the amount of investment (mostly irreversible) in the beginning times. People would choose to work with minimum wage without taking any risks and bearing any

Table 7 - PMG Panel ARDL regression results.

Long Run Equation				
Variable	*Coefficient*	*Std. Error*	*t-Stat.*	*p-value*
LSP	5.2153	1.3427	3.8841	0.0001
LFP	-4.7982	5.3584	-0.8954	0.3711
LLSP	2.5909	0.8050	3.2187	0.0014
LMW	4.6106	1.1120	4.1460	0.0000
Short Run Equation				
ECC	-0.0233	0.0073	-3.1778	0.0016
C	-0.5837	0.1970	-2.9636	0.0032
ΔLSP	0.0061	0.0250	0.2434	0.8078
ΔLFP	-1.6052	0.4052	-3.9615	0.0001
ΔLLSP	0.1730	0.0377	4.5890	0.0000
ΔLMW	-0.5949	0.0777	-7.6595	0.0000
Mean dependent var	0.031409	S.D. dependent var		0.0450
S.E. of regression	0.039982	Akaike info criterion		-3.3600
Sum squared resid	0.641008	Schwarz criterion		-0.7245
Log likelihood	1986.874	Hannan-Quinn criterion		-2.3527

costs in the short run. However, from short run to long run the picture reversed and minimum wage impact on the livestock sector becomes significantly positive. Even if, the workforce is oriented towards areas with minimum wage, employers can reduce their worker demand. Since in Turkey, those working with minimum wage comprise approximately 41% of the total number of employees, this reaction of employers would cause to lack of employment threat. In the long run, entrepreneurs would move to the agriculture and livestock sectors, considering fear of unemployment in other sectors, if the minimum wage is relatively high.

4. Conclusion

Turkey, which employs approximately one-fifth of its workforce in the agricultural sector, is among the highest agricultural support providing countries in comparison to its GDP in the world. On the other hand, livestock supports have an important share in agricultural supports. Especially during the last decades, the share of livestock supports in total agricultural supports has increased significantly. In this respect, the production effect of livestock supports is an important issue that needs to be covered.

In this paper, the relationship between livestock supports and livestock production is empirically analyzed on a province basis with yearly-frequented data covering 2010-2020. The results of Panel ARDL method are extremely remarkable. Findings show that the relationship between livestock supports and production is statistically insignificant in the short run. Therefore, increase in livestock and establishment of additional facilities require a time period. Practically, it is difficult for producers to respond to the increases in supports in the short run. In other words, producers can not react instantly to livestock supports due to infrastructural constraints in the short run. Furthermore, short run uncertainties about the livestock supports may cause hesitation for producers in reacting quickly. Although, the effect of supports on livestock presence is insignificant in the short run, it has a positive and significant effect in the long run. The results indicate that livestock supports affect livestock production positively in the long run. To put it in another way, livestock payments are an important indicator for farmers in the long run.

Coefficient of feed prices representing input costs is negative as expected in the short and long run but statistically significant only in the short run equation. The results show that increases in the price of feed, as a substantial input, harm livestock sector in the short run. Producers, whose profitability decreases with the increase in costs, not only reduce their production scales but also diminish livestock presence in the short run. Considering the costs of scaling down or – even worse – disengagement from the market, decisions of producers vary in the long run. Decisions ofIn addition, the rigidity of labor transfer between sectors in Turkey results in farmers turning to policies that will compensate for their income losses in the long run rather than reducing livestock presence.

One of the variables that directly affect livestock presence is the price of livestock. Findings reveal that increases in livestock prices have a positive effect on the number of livestock in the short and long run. Yet, in the long run, production effect of livestock price is greater than it is in the short run since scale and time constraints faced by the producers limit the production. The results are extremely important in terms of showing that not only livestock supports but also livestock prices effects producer behaviour.

It is inevitable that changes in the minimum wage will have some effects on the agricultural and livestock sectors in Turkey, where nearly half of the workforce earns minimum wage. The results obtained in this study regarding the effect of minimum wage on the presence of livestock is extremely striking. Accordingly, results are negative in the short run and positive in the long run. Employees in Turkey would run away from the sectors such as livestock and agricultural industry due to unique sectoral risks, high amount of irreversible investment costs and not decent working conditions if minimum wage is not satisfactory for them. Meaning, increase in minimum wage makes other sectors more attractive for working; mainly, service industries where no investment risks have to be taken. This can also be described with migration phenomenon from rural to urban. Such situations explain the negative short run effects of increasing minimum wage on livestock industry.

On the other side, a relatively high level of minimum wage would drive employers away in hiring more employees; even in some cases, they would fire existing employees in order to optimize their profits. In such a scenario, employees would choose to work in livestock and agricultural industry only to avoid potential risk of unemployment which is again related to the fact that service industry does not provide enough employment opportunities at minimum wage level. This forms another motivation for working in the livestock industry. From this point of view, increasing the minimum wage assists amplification of production in livestock industry only on the long run.

The findings have important implications for policy measures. First of all, livestock supports are an important policy tool for directing production and producers. It shows that increasing livestock supports to close supply gap achieves its main purpose; as it is expected. However, not only livestock supports but also livestock prices are effective in the production decision of producers. In other words, livestock support and price policy can be used effectively in the livestock sector. Findings also show that changes in inputs such as minimum wage and feed price effect production negatively in the short run. In order to eliminate the negative effects of increases in input prices, alternative policies such as feed supports and tax advantages should be implemented for alleviating cost pressure on the producers.

The livestock sector has a great importance for Turkey. In this sense, this study, which is conducted for the first time covering 81 provinces in Turkey, reached comprehensive and strong results on the impact of agricultural support, livestock prices and costs over the livestock sector. Although livestock supports and other variables have various consequences on livestock production; other effects, especially created by livestock supports are substantial subjects of this study. In this context; input prices, grazing rents and environmental impacts of livestock supports are significant study areas awaiting explanation.

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