# Economic Effectiveness of Livestock Farming Industry: An Analysis between Turkey and Eu-15 Countries

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## Abstract

*Livestock farming is one of leading sectors both in Turkey and in the world with its internal and external benefits. Besides, policies followed with regard to a country's economics are the greatest factors that affect the agricultural and livestock farming sectors. Particularly after 1980, Turkey made a vast scale of investment in the industrial sector along with a growth model based on exportation and supported these sectors using various methods; however, agricultural and livestock farming sectors fell behind the industrial sector. Agricultural and livestock farming sectors in Turkey fell behind especially such sectors of Europe because efficiency in agriculture couldn't increased due to land fragmentation. In this study, basic information regarding the livestock farming sector in Turkey was given and an econometric model was generated regarding to what extent GDP is affected by the livestock farming sector and its components in both Turkey and first 15 countries of the European Union. Accordingly, we observed that although livestock farming production in general is defined as a factor that increases GDP, an increase in agricultural workforce particularly in economies that rely on the manufacturing industry sector is a factor that decreases GDP.*

**Keywords:** Turkish Economics, Livestock Farming, Panel Data Analysis

**Jel Codes:** Q22, C33

### *Introduction*

For centuries, the agricultural sector in Turkey has been among the most important sectors in terms of both households and economics. Towards the half of the 20$^{th}$ century, Turkey was introduced to the thought of increasing the national income by means of increasing investment in the industrial sector that emerged particularly after the industrial revolution and by means of increasing the industrial foreign trade. However, the situation observed in developed countries which involves shrinking agricultural sector, but increasing efficiency and supporting the industrial sector was not observed in economy of Turkey unfortunately and the agricultural sector lost its importance gradually. This is why Turkey, which is an agricultural products exporter, has become a country that imports such products. Another indispensable branch of the agricultural sector is livestock farming sector.

Along with providing food for the country, livestock farming sector in Turkey has undertaken important economic functions such as increasing exportation, providing raw materials for the industry, achieving a consistent development through a balanced development of regions and sectors, preventing disguised unemployment in rural areas and migration, creating new employment opportunities in industrial and services sectors, and basing financing of development on its own resources.

The functions undertaken by the livestock farming sector with regard to the economic development of Turkey can be listed as follows. (Cevger et al. 2011: 17-18):

- The function of providing an opportunity for a better nutrition as well as raw materials for the industry,
- The function of increasing the national income and improving the exportation,
- The function of providing workforce for the industrial and services sectors and creating an employment volume within the livestock farming sector,
- The function of contributing to the financing of development,
- The function of realizing a balanced development among regions, and
- The function of realizing a consistent economic development.

Livestock farming provides raw materials for various industrial branches such as meat, milk, egg, textile, wool and leather, helps in establishment and development of sub-industrial branches such as feed, medicine and equipment, and contributes to exportation of the country. Furthermore, animal manure is used in vegetative production, improving physical structure of soil and increasing the efficiency. Livestock farming enables utilization of the idle workforce in business organizations especially in the winter seasons during which no vegetative production activities take place in agricultural organizations. Since vegetative production relies on climatic conditions, livestock farming is a source of an additional income for agricultural organizations. (Bayrac and Cemrek, 2011: 2) As economics develops and advances, some sub-branches have emerged and specialized. One of them is livestock farming, which has specialized in rural areas and agriculture.

Livestock farming creates more than half of the value of the agricultural output in the world and one third of it in developing countries. Rapid growth in demand for livestock products (LPs) for the developing countries is viewed as a 'food revolution'. LPs are costly with regard to the staple food, therefore consumption levels in developing countries are still low, but they increase in line with rising incomes. Pork and particularly poultry meat consumption has the highest rate of growth. Growth in consumption is at the expense of increasing net imports of all LPs. Increased production and higher self-sufficiency would save foreign exchange. Livestock farming also contributes to rural livelihoods, employment and poverty relief. They integrate with and complement crop production, embody savings and provide a reserve against risks. Some livestock products have special roles in traditional culture. (Upton, 2014: 1)

Incentives and subvention have been the most used means in public policies that aim to govern and support the livestock farming sector, which is an important branch of agriculture in Turkey. Generally, the purpose of intervention is to meet raw material need of the food industry or to protect consumers. On the other hand, the main purpose of state intervention in countries with insufficient production should be maintain sustenance and sufficiency in production, protect the producers and decrease costs. Organizations established by producers have not reached an effective level yet with respect to creating policies about livestock farming and implementing the prescribed policies. Bargaining powers of small-sized enterprises, which are common in Turkey, is very low with regard to both sale of products and provision of inputs. This primarily leaves the producers no choice but sell their products with low prices and buy inputs at high prices. (Bayrac and Cemrek, 2011: 2)

The following Table 1 and Table 2 show number of cattle and sheep & goats in Turkey during the 2000-2013 period respectively.

**Table 1: Number of Cattle in Turkey during the 2000-2013 Period**

| Years | Cow (Breed) | Cow (Cross-breed) | Cow (Local) | Water Buffalo |
|---|---|---|---|---|
| 2000 | 1806000 | 4738000 | 4217000 | 146000 |
| 2001 | 1854000 | 4620000 | 4074000 | 138000 |
| 2002 | 1859786 | 4357549 | 3586163 | 121077 |
| 2003 | 1940506 | 4284890 | 3562706 | 113356 |
| 2004 | 2109393 | 4395090 | 3564863 | 103900 |
| 2005 | 2354957 | 4537998 | 3633485 | 104965 |
| 2006 | 2771818 | 4694197 | 3405349 | 100516 |
| 2007 | 3295678 | 4465350 | 3275725 | 84705 |
| 2008 | 3554585 | 4454647 | 2850710 | 86297 |
| 2009 | 3723583 | 4406041 | 2594334 | 87207 |
| 2010 | 4197890 | 4707188 | 2464722 | 84726 |
| 2011 | 4836547 | 5120621 | 2429169 | 97632 |
| 2012 | 5679484 | 5776028 | 2459400 | 107435 |
| 2013 | 5954333 | 6112437 | 2348487 | 117591 |

**Source:** Prepared by authors using Turkish Statistical Institute data base. (Retrieved: 20.06.2014)

Table 1 suggests that Cow (Breed) column has the biggest increase in number of cattle. Particularly, an increase of 17%, 18% and 17% with respect to the previous year was realized in 2006, 2007 and 2012 respectively. The biggest decrease is for the number of water buffalo in 2002 with 12%.

**Table 2: Number of Sheep & Goats in Turkey during the 2000-2013 Period**

| Years | Sheep (Local) | Sheep (Merino) | Goat (Hair) | Goat (Angora) |
|---|---|---|---|---|
| 2000 | 27719000 | 773000 | 6828000 | 373000 |
| 2001 | 26213000 | 759000 | 6676000 | 346000 |
| 2002 | 24473826 | 699880 | 6519332 | 260762 |
| 2003 | 24689169 | 742370 | 6516088 | 255587 |
| 2004 | 24438459 | 762696 | 6379900 | 230037 |
| 2005 | 24551972 | 752353 | 6284498 | 232966 |
| 2006 | 24801481 | 815431 | 6433744 | 209550 |
| 2007 | 24491211 | 971082 | 6095292 | 191066 |
| 2008 | 22955941 | 1018650 | 5435393 | 158168 |
| 2009 | 20721925 | 1027583 | 4981299 | 146986 |
| 2010 | 22003299 | 1086392 | 6140627 | 152606 |
| 2011 | 23811036 | 1220529 | 7126862 | 151091 |
| 2012 | 25892582 | 1532651 | 8199184 | 158102 |
| 2013 | 27485166 | 1799081 | 9059259 | 166289 |

**Source:** Prepared by authors using Turkish Statistical Institute data base. (Retrieved: 20.06.2014)

Table 2 shows that the biggest increase in number of sheep & goats is for sheep (merino) in 2012 (25%), for goat (hair) in 2010 (23%) and again for sheep (merino) in 2007 (19%). As for the total number of sheep & goats during the 2000-2013 period, 76% of them are sheep (local), 20% are goat (hair), 3% are sheep (merino) and 1% are goat (angora).

**Table 3: Number of Fowls in Turkey during the 2000-2013 Period**

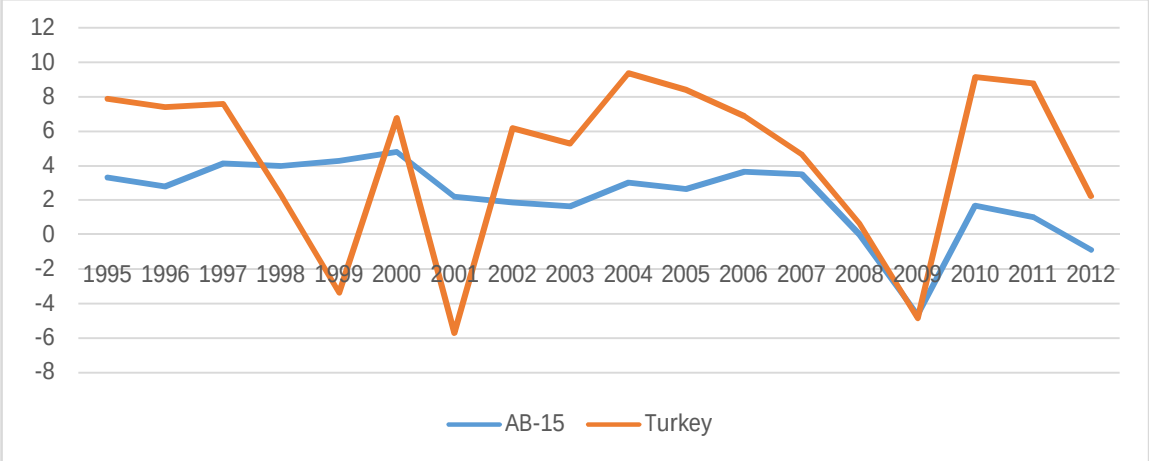
| Years | Laying hen | Broiler | Turkey | Goose | Duck |
|---|---|---|---|---|---|
| 2000 | 64709040 | 193459280 | 3681558 | 1496604 | 1104176 |
| 2001 | 55675750 | 161899442 | 3254018 | 1397560 | 913748 |
| 2002 | 57139257 | 188637066 | 3092408 | 1400136 | 832091 |
| 2003 | 60399520 | 217133076 | 3994093 | 1336775 | 810910 |
| 2004 | 58774172 | 238101895 | 3902346 | 1250634 | 770436 |
| 2005 | 60275674 | 257221440 | 3697103 | 1066581 | 656409 |
| 2006 | 58698485 | 286121360 | 3226941 | 830081 | 525250 |
| 2007 | 64286383 | 205082159 | 2675407 | 1022711 | 481829 |
| 2008 | 63364818 | 180915558 | 3230318 | 1062887 | 470158 |
| 2009 | 66500461 | 163468942 | 2755349 | 944731 | 412723 |
| 2010 | 70933660 | 163984725 | 2942170 | 715555 | 396851 |
| 2011 | 78956861 | 158916608 | 2563330 | 679516 | 382223 |
| 2012 | 84677290 | 169034283 | 2760859 | 676179 | 356730 |
| 2013 | 88720709 | 177432745 | 2925473 | 755286 | 367821 |

**Source:** Prepared by authors using Turkish Statistical Institute data base. (Retrieved: 20.06.2014)

Table 3 shows the number of fowls in Turkey during the 2000-2013 period. During the 14 years' period, 73% of total fowls is broiler and 25% is laying hens. Number of broilers is observed to have decreased by 28% in 2007 with respect to the previous year. In the same period, number of laying hens increased by 10%.

Socio-economic structure in rural areas receded after 1980 because government support for livestock products stopped, livestock product prices began to be established in an imperfect market and support for vegetative products continued. This problem impaired the interaction between markets, which is a very important factor in terms of development.

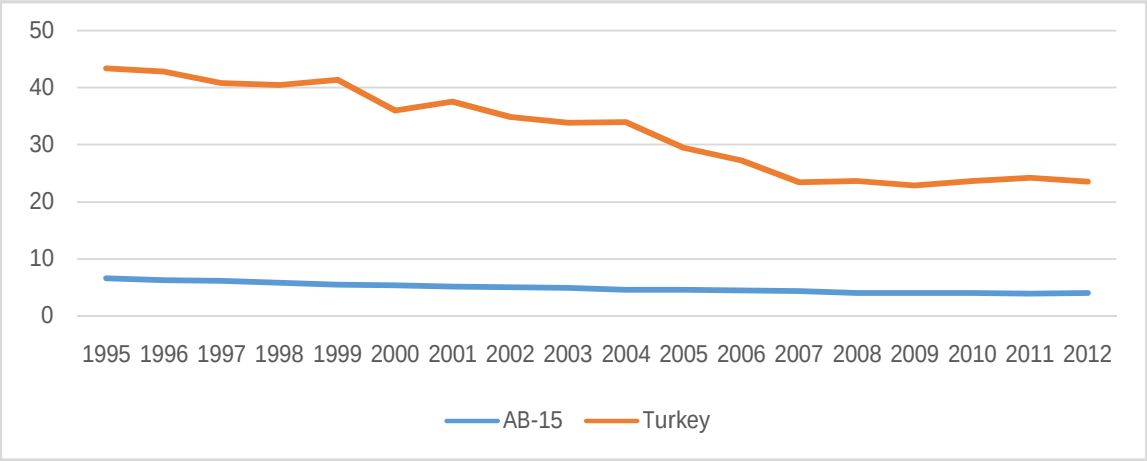
**Figure 1: GDP Rates of Growth of EU-15 (average) and Turkey (%)**




**Source:** Prepared by authors using Turkish Statistical Institute data base. (Retrieved: 20.06.2014)

Figure 1 shows GDP percentage changes of growth of EU-15 and Turkey during the 1995-2012 period. These changes were calculated based on exchange rate of USA Dollar for year 2005. Accordingly, decreases of GDP in Turkey in 1999 and 2001 are remarkable. On the other hand, change of GDP in EU countries took place in a narrower band. The most important point is that the economic crisis covering the 2008-2009 period affected all countries. Decrease of GDP for said period is also remarkable.

**Figure 2: Agricultural Employment Rates of EU-15 (average) and Turkey (%)**




**Source:** Prepared by authors using Turkish Statistical Institute data base. (Retrieved: 20.06.2014)

Figure 2 shows agricultural employment rates of EU-15 and Turkey during the 1995-2012 period. These rates are given as a percentage of the total employment. Accordingly, the great size of agricultural workforce in economy of Turkey is remarkable. Average of EU-15 didn't reach even the half of the realized rate in Turkey. This indicates the inefficiency of the agricultural sector within the economy of Turkey, which cannot generate a high income from such sector.

Organization of the livestock farming sector contains models such as associations, unions, cooperatives and boards. The fact that producers in developed countries have grown stronger by means of such sort of organizations has a great effect on the fact that the share of livestock farming in the general agricultural sector is bigger than that of vegetative production. The existing potential in livestock farming should be set into motion by means of rational economic policy steps that will taken to accomplish the rural economic development. For locomotive of the rural economic development in Turkey shall be the livestock farming sector as is the case with the world. The reason is that in no developed country, rural economic development was accomplished without achieving development in livestock farming. (Ertugrul, 2000: 39)

Livestock farming, which is the locomotive of the agricultural economy in developed countries, is important in terms of two aspects. Firstly, it creates an employment with a very low cost, and secondly it transforms the sources of feed, which are of poor quality or unsuitable for human nutrition, into human food of good quality. Along with providing food for the country, livestock farming sector in Turkey has undertaken many important socio-economic functions such as increasing exportation, providing raw materials for the industry, achieving a consistent and balanced development of regions and sectors, preventing disguised unemployment in rural areas, and creating new employment opportunities in industrial and services sectors (Kutlu et al., 2003, 6)

## *Material and Methods*

In this study, a panel data analysis on Turkey and EU 15 member countries (Belgium, France, Netherlands, Luxembourg, Germany, Italy, Denmark, United Kingdom, Ireland, Greece, Portugal, Spain, Austria, Finland and Sweden) for the 1995-2012 period was examined. The involved variables were GDP growth (annual rate of change of GDP), agriemploy (annual rate of change of agricultural employment), agriland (annual rate of change of agricultural lands), livestock (annual rate of change of livestock) and ruralpop (rate of change of rural population). Since all variables were proportional, they were not converted to logarithmic series. Gauss 9.0 and Eviews 7.0 econometrics software was used in the study.

First of all, stationariness of the series was tested using panel unit root tests in the analysis. If existence of cross-section dependency in the panel data set is rejected, conventional unit root tests may be used. However, if there exists a cross-section dependency in the panel data, more consistent, more effective and stronger estimations can be made by using new generation unit root tests. Methods used to test cross-section dependency in the panel data sets were Pesaran et al. (2006) $CD_{LM}$ test, Breusch-Pagan (1980) $CD_{LM1}$ test and Pesaran et al. (2006) $CD_{LM2}$ tests. $CD_{LM1}$ and $CD_{LM2}$ tests are the estimators that test the existence of cross-section dependency in the T>N case.

$CD_{LM}$ test is an estimator that tests the existence of cross-section dependency in the N>T case. 11 years covering the 2002-2012 period (T) and 6 Central Asian Turkic Republics (N) satisfied the necessary conditions in this study for applicability of $CD_{LM1}$ and $CD_{LM2}$ tests. In $D_{LM1}$ and $CD_{LM2}$ tests, estimations were made assuming that each cross-section can be affected from individual vertical section separately (Guloglu and Ivrendi, 2008: 384). The following table shows the results of the cross-section dependency tests.

**Table 7: Cross Section Dependency Tests**

| **gdpgrowth** | **Statistic** | **Probability** |
|---|---|---|
| CD $LM_1$ (Breusch and Pagan 1980) | 209.719 | 0.000 |
| CD $LM_2$ (Pesaran 2004 $CD_{LM}$) | 5.791 | 0.000 |
| CD LM (Pesaran 2004 CD) | 0.809 | 0.209 |
| **agriemploy** | **Statistic** | **Probability** |
| CD $LM_1$ (Breusch and Pagan 1980) | 196.033 | 0.000 |
| CD $LM_2$ (Pesaran 2004 $CD_{LM}$) | 4.908 | 0.000 |
| CD LM (Pesaran 2004 CD) | 0.753 | 0.226 |
| **agriland** | **Statistic** | **Probability** |
| CD $LM_1$ (Breusch and Pagan 1980) | 195.675 | 0.000 |
| CD $LM_2$ (Pesaran 2004 $CD_{LM}$) | 4.885 | 0.000 |
| CD LM (Pesaran 2004 CD) | 0.430 | 0.334 |
| **livestock** | **Statistic** | **Probability** |
| CD $LM_1$ (Breusch and Pagan 1980) | 171.078 | 0.002 |
| CD $LM_2$ (Pesaran 2004 $CD_{LM}$) | 3.297 | 0.000 |
| CD LM (Pesaran 2004 CD) | 0.400 | 0.345 |
| **ruralpop** | **Statistic** | **Probability** |
| CD $LM_1$ (Breusch and Pagan 1980) | 715.940 | 0.000 |
| CD $LM_2$ (Pesaran 2004 $CD_{LM}$) | 38.468 | 0.000 |
| CD LM (Pesaran 2004 CD) | -0.481 | 0.315 |

Table 7 contains tests that investigate whether variables in the model handled in the study have a cross-section dependency or not. Accordingly, the argument that variables in question don't have a cross-section dependency was rejected according to $CDLM_1$ and $CDLM_2$ tests with a significance level of 1%. Therefore, such variables have cross-section independence and whether they include unit root bar or not according to first generation unit root tests can not be investigated. However, stationariness analysis of the variables can be investigated according to second generation panel unit root tests.

**Table 8: CADF and CIPS Unit Root Tests (Level)**

| **Countries** | **gdpgrowth** | **agriemploy** | **agriland** | **livestock** | **ruralpop** |
|---|---|---|---|---|---|
| **belgium** | -2.39** | -1.601 | -1.534 | -0.752 | -1.969 |
| **france** | -3.33* | -0.980 | -1.726 | -0.237** | -2.635* |
| **netherlands** | -1.28 | -2.083 | -0.638 | -2.415** | 1.773 |
| **luxembourg** | -3.64* | -3.589* | -4.216* | -1.419 | -2.346** |
| **germany** | -0.560 | -0.405 | -0.8 62 | -0.265 | -0.941 |
| **italy** | -3.37* | -2.871* | -1.885 | -2.070 | 1.820 |
| **denmark** | -2.04 | -7.650* | -3.242* | -2.259*** | -2.723* |
| **uk** | -1.30 | -1.870 | -2.077 | -2.007 | 1.975 |
| **ireland** | -0.669 | -3.622* | -1.254 | -1.166 | -1.066 |
| **greece** | -1.36 | -0.748 | -2.396** | -2.171*** | 2.054 |
| **portugal** | -1.58 | -4.100* | -3.262* | -2.924* | 2.099 |
| **spain** | -2.78* | -1.394 | -1.425 | -3.064* | 0.806 |
| **austria** | -1.04 | -1.760 | 0.892 | -1.093 | -1.591 |
| **finland** | -2.64* | -0.577 | -2.953* | -4.683* | -1.972 |
| **sweden** | -2.65* | -0.342 | -2.796* | -0.251 | 0.215 |
| **turkey** | -2.62* | -1.563 | -1.052 | 1.507 | -1.104 |
| **CIPS** | -2.08 | -2.197*** | -1.902 | -1.579 | -0.350 |

(Critical values for CADF and CIPS are -2.47 for 1%, -2.26 for 5%, and -2.14 for 10%.)

Table 8 shows unit root analyses regarding the variables handled in the model. Analyses in question were tested using CADF and CPS tests which consider cross-section formation. Such tests were analyzed separately with respect to the levels and first difference values of the variables, and table 8 shows level values and table 9 shows difference values. As a result of the fact that most of the variables in Table 8 don't contain a unit root and are not stationary, we decided to consider the first differences of the series and investigate their stationariness. Variables in Table 9 are the first difference calculated form of the variables in Table 8. Accordingly, it is remarkable that more variables in Table 9 do not contain a unit root especially with a significance level of 1 percent and are stationary, compared to Table 8. This suggests that a panel data model can be established using first differences of the considered variables. Table 10 shows the descriptive statistics regarding the variables included within the model.

**Table 9: CADF and CIPS Unit Root Tests (1st Difference)**

| Countries | dgdpgrowth | dagriemploy | dagriland | dlivestock | druralpop |
|---|---|---|---|---|---|
| **belgium** | -3.73* | -1.789 | -2.444** | -2.497* | -1.593 |
| **france** | -3.44* | -2.700* | -0.644 | -2.047 | -1.168 |
| **netherlands** | -1.85 | -2.326** | -1.674 | 0.844 | 0.438 |
| **luxembourg** | -2.37** | -5.086* | -5.173* | -3.066* | -1.547 |
| **germany** | -0.611 | -1.719 | -2.869* | -1.762 | -1.576 |
| **italy** | -3.29* | -3.944* | -1.733 | -2.121 | -0.068 |
| **denmark** | -2.60* | -4.149* | -1.672 | -3.890* | -0.844 |
| **uk** | -1.91 | -1.581 | -1.703 | -2.603* | 0.035 |
| **ireland** | -3.62* | -2.276** | -5.213* | -3.739* | -0.871 |
| **greece** | -2.60* | -2.877* | -2.597* | -2.886* | 0.060 |
| **portugal** | -2.59* | -3.789* | -6.855* | -4.040* | 0.165 |
| **spain** | -2.54* | -3.645* | -2.841* | -1.789 | -0.110 |
| **austria** | -5.24* | -1.897 | -1.821 | -2.610* | -1.623 |
| **finland** | -3.04* | -1.618 | -3.968* | -4.035* | -1.533 |
| **sweden** | -2.96* | -1.628 | -2.128 | -2.106 | -1.421 |
| **turkey** | -2.58* | -2.503* | -1.818 | -0.649 | -0.902 |
| **CIPS** | -2.81* | -2.720* | -2.822* | -2.437** | -0.785 |

(Critical values for CADF and CIPS are -2.47 for 1%, -2.26 for 5%, and -2.14 for 10%.)

**Table 10: Descriptive Statistics of Variables**

| | dgdpgrowh | dlivestock | dagriemploy | dagriland | druralpop |
|---|---|---|---|---|---|
| **Mean** | -0.252695 | 0.268750 | -0.217647 | -0.118775 | -0.247624 |
| **Median** | -0.311139 | 0.245000 | -0.100000 | -0.078378 | -0.146800 |
| **Maximum** | 13.98283 | 18.85000 | 1.599998 | 27.46005 | 0.043800 |
| **Minimum** | -12.47193 | -18.22000 | -5.400002 | -27.79286 | -0.932000 |
| **Std. Dev.** | 3.096259 | 3.489978 | 0.649198 | 2.497385 | 0.243665 |
| **Skewness** | 0.937799 | -0.251407 | -4.035481 | -0.011693 | -1.245710 |
| **Kurtosis** | 7.730442 | 11.23379 | 28.35858 | 111.0984 | 3.434727 |
| **Jarque-Bera** | 293.4761 | 771.2118 | 8026.243 | 132432.9 | 72.48979 |
| **Probability** | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| **Sum** | -68.73294 | 73.10000 | -59.20000 | -32.30689 | -67.35380 |
| **Sum Sq. Dev.** | 2598.028 | 3300.766 | 114.2153 | 1690.209 | 16.08997 |
| **Observations** | 272 | 272 | 272 | 272 | 272 |

In Table 11, suitability of the fixed-fixed effect model used in the panel data analysis is investigated. If cross-section series (countries) and vertical section series (years) in the model have been fictionalized properly according to the fixed effect model, probability values should be close to 1%. However, since the table reveals, such probability could not be achieved in cross-section series. So, the model to be applied in the panel data analysis should be a model in which only vertical section series shall be determined as constant.

**Table 11: Fixed Model Test of Equation**

| Effects Test | Statistic | d.f. | Prob. |
|---|---|---|---|
| **Cross-section F** | 0.319035 | (15,236) | 0.9932 |
| **Cross-section Chi-square** | 5.460352 | 15 | 0.9875 |
| **Period F** | 26.701268 | (16,236) | 0.0000 |
| **Period Chi-square** | 281.050907 | 16 | 0.0000 |
| **Cross-Section/Period F** | 14.012470 | (31,236) | 0.0000 |
| **Cross-Section/Period Chi-square** | 283.974181 | 31 | 0.0000 |

In studies using panel data, a way to include the change caused by differences between units or differences occurred between units and in time, into the model assumes that the existing change causes a change in some or all of the coefficients of the regression model. Models in which coefficients are assumed to change with respect to the units or units and time are called fixed-effects model. Formulation of this model assumes that differences between units can be caught in differences between constant terms. For this purpose, the panel data model is estimated by the help of a dummy variable. In the following equation, this is assumed to have occurred. Here, only constant term has changed and it displays differences in terms of section, not time. In other words, the time is stated to display differences between individuals although it is maintained by the constant term. (Pazarcioglu and Gurler, 2008: 37 - 38).

$\beta_{1it} = \beta_1$; $\beta_{3it} = \beta_3$; $\beta_{3it} = \beta_3$
$y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + e_{it}$ equation is constructed.

**Dgdp growth**= -0.2843 + 0.0139**dlivestock** – 0.5913**dagriemploy** + 0.0383**dagriland** + 0.3885**druralpop**

| | | | | | |
|---|---|---|---|---|---|
| **std. error** | 0.0604 | 0.0291 | 0.2892 | 0.0158 | 0.3870 |
| **t stats.** | -4.7022 | 0.4776 | -2.0444 | 2.4131 | 1.0038 |
| **prob.** | 0.0000 | 0.6333 | 0.0420 | 0.0165 | 0.3164 |

**$R^2$=** 0.65 **DW=** 2.7041 **F stat.=** 23.3289 **Prob.=** 0.0000

In the above model, a panel was considered that consists of Turkey and first 15 member countries of the European Union, namely Belgium, France, Netherlands, Luxembourg, Germany, Italy, Denmark, United Kingdom, Ireland, Greece, Portugal, Spain, Austria, Finland and Sweden, and to what extent the percentage changes of livestock production, agricultural employment, agricultural land and rural population realized in countries in question affect annual GDP of these countries was investigated.

Accordingly, a 1% increase of annual livestock production in the above model increases GDP by 0.01%. A 1% increase of agricultural employment decreases GDP by 0.59%, which is a significant value. This indicates that the economies of the countries in question depend on mainly the industrial sector. A 1% increase of agricultural lands increases GDP by 0.03%. A 1% increase of rural population increases the dependent variable by 0.38%.

**Table 12: Period Effects of Model**

| Date | Effect |
|---|---|
| 1/1/1996 | -0.351358 |
| 1/1/1997 | 1.468120 |
| 1/1/1998 | -0.274000 |
| 1/1/1999 | 0.123908 |
| 1/1/2000 | 1.222869 |
| 1/1/2001 | -2.886910 |
| 1/1/2002 | 0.625560 |
| 1/1/2003 | 0.079557 |
| 1/1/2004 | 1.709424 |
| 1/1/2005 | -0.220012 |
| 1/1/2006 | 1.108409 |
| 1/1/2007 | -0.029170 |
| 1/1/2008 | -3.348149 |
| 1/1/2009 | -4.351944 |
| 1/1/2010 | 7.200000 |
| 1/1/2011 | -0.289872 |
| 1/1/2012 | -1.786432 |

Table 12 shows the effects of the years, i.e. vertical section series, on the established model. This could be shown as a new sub-heading as contributions of the cross-sections to the model if this situation was handled as a fixed-fixed effect model. However, since only vertical section series are handled in the model in a manner having a fixed effect, the changes in the table in question would be sufficient. Accordingly, it is not possible to mention a somehow increasing or decreasing year effect similar to the year effect involved in the characteristic structure of the agricultural production. However, it is possible to mention that independent variables have increasing or decreasing effects on dependent variables every year. This has become apparent particularly in 2008, 2009 and 2010, and effects of independent variables on dependent variables in these years become more effectual in a decreasing or increasing manner. Of course, economic fluctuations experienced in these years have a significant share.

**Table 13: Granger Causality Tests**

| **Pairwise Granger Causality Tests** | | | |
|---|---|---|---|
| **Sample: 1995 2012** | | | |
| **Lags: 4** | | | |
| **Null Hypothesis:** | **Obs** | **F-Statistic** | **Prob.** |
| DAGRIEMPLOY does not Granger Cause DGDPGROWTH | 208 | 2.56437 | 0.0396 |
| DGDPGROWTH does not Granger Cause DAGRIEMPLOY | | 2.47594 | 0.0455 |
| **DAGRILAND does not Granger Cause DGDPGROWTH** | 208 | 0.10147 | 0.9819 |
| **DGDPGROWTH does not Granger Cause DAGRILAND** | | 2.00881 | 0.0947 |
| DAGRIEMPLOY does not Granger Cause DLIVESTOCK | 208 | 5.18579 | 0.0005 |
| DLIVESTOCK does not Granger Cause DAGRIEMPLOY | | 1.58501 | 0.1797 |
| **DRURALPOP does not Granger Cause DLIVESTOCK** | 208 | 2.31188 | 0.0590 |
| **DLIVESTOCK does not Granger Cause DRURALPOP** | | 0.76478 | 0.5493 |
| DAGRILAND does not Granger Cause DAGRIEMPLOY | 208 | 1.02635 | 0.3948 |
| DAGRIEMPLOY does not Granger Cause DAGRILAND | | 3.29236 | 0.0122 |

Table 13 shows the Granger causality analyses that realized among the variables within the model handled in this study. Accordingly, the change that took place in GDP and the change that took place in the agricultural workforce are Granger causes of each other with a significance level of nearly 4%. Again, the change that is observed in GDP is the cause of the change observed in the agricultural area with a significance level of approximately 10%. The change that is observed in the agricultural workforce is the cause of the change that is observed in the livestock production with a significance level of 1%. The change that is observed in the rural population is the cause of the change that is observed in the livestock production with a significance level of 5%. Finally, the change that is observed in the agricultural workforce is the cause of the change that is observed in the agricultural lands with a significance level of 1%.

**Table 14: Pedroni Cointegration Test**

| **Sample:** 1995 2012 | | | | |
|---|---|---|---|---|
| **Included observations:** 288 | | | | |
| **Cross-sections included:** 16 | | | | |
| **Null Hypothesis:** No cointegration | | | | |
| **Trend assumption:** Deterministic intercept and trend | | | | |
| **Lag selection:** fixed at 1 Newey-West bandwidth selection with Bartlett kernel | | | | |
| **Alternative hypothesis:** common AR coefs. (within-dimension) | | | | |
| | **Statistic** | **Prob.** | **Weighted Statistic** | **Prob.** |
| **Panel v-Statistic** | -4.044207 | 0.0001 | -5.234206 | 0.0000 |
| **Panel rho-Statistic** | 1.577742 | 0.1149 | 2.326443 | 0.0266 |
| **Panel PP-Statistic** | -14.79600 | 0.0000 | -16.27941 | 0.0000 |
| **Panel ADF-Statistic** | -4.195451 | 0.0001 | -5.131908 | 0.0000 |
| **Alternative hypothesis:** individual AR coefs. (between-dimension) | | | | |
| | **Statistic** | **Prob.** | | |
| **Group rho-Statistic** | 3.782963 | 0.0003 | | |
| **Group PP-Statistic** | -24.12706 | 0.0000 | | |
| **Group ADF-Statistic** | -5.073929 | 0.0000 | | |

Table 14 shows the cointegration analysis that indicates whether the variables in question have a long-term relationship among themselves according to the panel data model that is established between 15 EU countries and Turkey for the 1995-2012 period. According to Pedroni cointegration analysis, all dependent and independent variables have a long-term relationship among themselves with a significance level of maximum 2%.

### *Results and Discussion*

In this study, the livestock farming sectors of Turkey and selected EU 15 member countries were investigated. In the model part of the study, the effects of the rural areas, livestock farming, agricultural workforce and agricultural lands on change of national GDP were investigated by means of a balanced panel model including Turkey and EU 15 member countries. In the model in question, causality analyses and a cointegration analysis that questions whether there is a long-term relationship among the variables were used. Evidences of causality and long-term relationship among many variables with a high significance level were discovered in the process in question. Interestingly, an increase in the agricultural workforce downgrades the national GDP highly in the regression equation that is called as the linear relationship model. This means that especially in today's economies, the industrial sector substitutes for agriculture.

During the EU full membership process, there are significant differences between livestock farming sector of the economy of Turkey and that of foreign countries. These differences include diseases that occur as a result of lack of hygiene, land fragmentation as a reality of Turkish agricultural sector as well as low efficiency as a result, lack of technical infrastructure as well as transportation problem between lands, insufficient transportation of values that result from production and shadow economy. These problems can only be overcome by means of a sufficient financial support and a decisive political will. Education of the people employed in the sector, bringing the technology to the country that will provide production increase, preventing animal diseases by means of increasing number of veterinarians, making the marketing channels more competitive through consolidating the producers under a certain roof would increase efficiency and make the agricultural sector more effective within the national output.

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