African Journal of Agricultural Research Vol. 5(13), pp. 1584-1590, 4 July, 2010
Available online at http://www.academicjournals.org/AJAR
ISSN 1991-637X ©2010 Academic Journals

Full Length Research Paper

An analysis on the production of potato in Turkey according to NUTS level 1 regions

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Accepted 2 April, 2010

This study tried to determine the distribution shares of potato production and reasons of change in distribution with respect to NUTS level 1 regions. For this purpose, 43 year data of regional time series covering the years (1963 - 1966)- (1980 - 1983) and (1980 - 1983) - (2002 - 2005) have been used in two periods and econometrically analyzed. The results obtained from the research show that dissimilar regions have relative advantages in potato production and focus is on this production. Particularly, potato production that is subject to market conditions after 1980 could be seen in the regions where production is lucrative and specialization has occurred spontaneously. It is necessary to speed up this process so as to increase the productivity of the agricultural sources. This could only be achieved by comprehensive researches based on the production and effective regional policies.

Key words: Potato production, NUTS level 1 regions, Turkey.

INTRODUCTION

Potato production in respect of NUTS level 1 regions that are established according to Nomenclature des Unites Territoriales Statistiques (NUTS 1) in Turkey has made an important transformation in 43 years between 1963 - 2005 (Figure 1). Despite the fact that this circumstance has affected some regions positively, some regions have been affected negatively. As seen in Figure 1, except the regions of Central Anatolia, Aegean and Middle East Anatolia, all other regions dropped the shares in the production of potato. This drop is rather much especially in the regions of West Anatolia, East Black Sea and East Marmara.

When this change is examined in periods, it is seen that change in the regional production shares after 1980 is absolutely prominent. Central Anatolian and Aegean Regions have increased their shares in Turkey's potato production between the years 1980 - 2005. On the contrary, especially regions of East Black Sea, West Black Sea, North East Anatolia and Mediterranean have decreased their production shares. Consequently, important structural changes have been experienced in Turkey's potato production especially after 1980 in respect of NUTS level 1 regions. The mentioned change in potato production is in favor of Central Anatolian and Aegean Regions and against all the other regions mainly the regions of West Anatolia, East Black Sea and Marmara. Where shares of Central Anatolia and Aegean Regions in Turkey's potato production were 38.21% between 1963 and 1966, this percentage has dropped to 62.21% between 2002 - 2005 (Anon, 1963 - 2005). Today, regional development has become one of the key issues of Turkey-European Union adaptation and integration pathway.

This led to development of a new understanding considering the regional structures and potentials while development plans are getting prepared and when decisions are made by policy makers. Determination of local competition advantages, specialization and effective use of the resources are absolutely important for the global competition (Gülten, 1985). The differences in the production shares among the regions show that ecological conditions, technology transfer, population, consuming habits and market conditions have significance on vegetal production design.

The aim of this study is to determine the distribution of the potato production shares and the reasons of this change in the distribution according to NUTS level 1 region and to compose base for further comprehensive studies. In the second part of the study; data used in the

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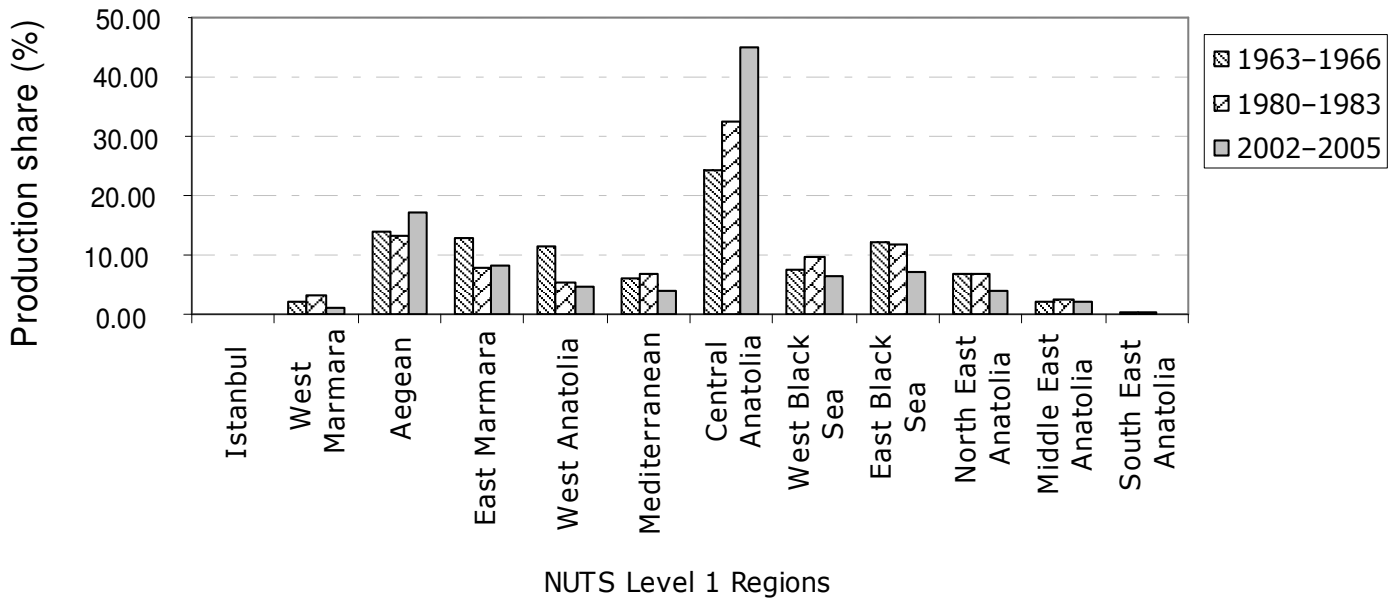

Figure 1. The share of Nuts Level 1 Regions in potato production in Turkey.

research, time period that is examined and methods used in econometric analysis have been explained and in the third part, results and findings have been reported, evaluations regarding the results are disclosed and the conclusions have been made.

MATERIAL AND METHODS

Data used in this research are secondary and have been compiled through various statistics, from internal and foreign literature. Data used in the model are 43 year time series that have been provided from Republic of Turkey-Prime Ministry, Turkish Statistics Institution (TUIK) Agricultural Structure and Production Statistics of 1963 - 2005. These data were obtained for provinces and then have been transformed into NUTS level 1 Regions (Figure 2). NUTS level 1 regions[1](Istanbul, West and East Marmara, Aegean, West and Central Anatolia, Mediterranean, West and East Black Sea, North East Anatolia, Middle East Anatolia, and South East Anatolia) have been selected in Turkey by considering Nomenclature des Unites Territoriales Statistiques.

So as to minimize the effects of periodicity and annual changes in the potato production, 43 years term have been split with 4 years average. Change in the potato production in respect of NUTS level 1 regions were examined by the averages of (1963 -1966) - (1980 - 1983) and (1980 -1983) - (2002 -2005). In the analysis; (1963 - 1966) and (1980 -1983) are the first period, (1980 -1983) and (2002 - 2005) are the second period and (1963 -1966) and (2002 - 2005) are expressed as the total.

The reason for the selection of these periods is to disclose the developments that planned economy started in 1963 till 1980 and implementing of free market conditions between 1980 - 2005. Econometric models regarding potato production in Turkey general and NUTS level 1 regions are as below.

[1] Nomenclature des Unites Territoriales Statistiques in Turkey was effective as of 28/08/2002 in accordance with the resolve 2002/4720 of Board of Ministers and 12 NUTS level 1 region have been composed after grouping the regional unit.

$$Y^k_i = \alpha^k + \beta^k_1 V_{i1} + \beta^k_2 E_{i2} + \beta^k_3 D_{i3} + U_i \quad (1)$$

Y = Potato production amount (ton)
V = Productivity (kg /ha)
E = Planting area (ha)
D = Climate (dummy)
i = 1.....516, 1.....240, 1.....276
k = 1, 2, 3
k = 1 (1963 -1982) period
k = 2 (1983 - 2005) period
k = 3 (1963 - 2005) period

$$Y^k_i = \alpha^k + \beta^k_1 V_{i1} + \beta^k_2 E_{i2} + U_i \quad (2)$$

Y = Potato production amount per regions (ton)
E = Planting area (ha)
V = Productivity (kg/ha)
i = 1....43
k = 1...12 (Regions)

Models used above are estimated by SHAZAM econometric software program.

The relationship between the estimation of econometric models and the variables, as well as, related parameters, have been determined and statically analyzed by using these parameters. So as to understand the effects of productivity, planting areas and climate on potato production for Turkey general, three dissimilar models have been analyzed using the data of first, second and 1963 - 2005 periods according to least squares method as applied, thanks to the time series data, autocorrelation was found in every three models (Gujarati, 1995; Yavuz, 2001). Parameters were re-estimated after this problem was solved by SHAZAM program (White et al., 1993). Similarly, in order to determine the effect of productivity and planting areas on potato production change within and inter-regions, Durbin-Watson test was applied to the estimated models. Except the estimated models for Istanbul and West Anatolia Regions, autocorrelation problem was seen in all the other models. After solving this problem, models were re-estimated.

Figure 2. Map of NUTS level 1 regions in Turkey.

Table 1. Potato production in Turkey between 1963 - 2005.

	Production (Average)			Change (%)		
	1963 - 1966	1980 - 1983	2002 - 2005	Period I	Period II	Total
Production (ton)	1700937	2996480	4848692	76.17	61.81	185.06
Area Sown (hectare)	145223	184746	181450	27.22	-1.78	24.95
Productivity (kg./hectare)	11713	16219	26722	38.47	64.76	128.14

Source: (Anon, 1963-2005).

RESULTS

Results for the potato production in Turkey between the years 1963 - 2005 are shown in Table 1. According to these results covering 43 years period, the increase in potato production is 185.06 and 24.65% in planting area and 128.14% in productivity. When potato production and planting area have been examined in respect of periods, it is seen that increase in potato production for the first period is more than the second period and though potato area sown have increased in the first period (27.22%), they have dropped in the second period (-1.78%). However, productivity has increased significantly in the second period (64.76%). The results concerning potato production in respect of NUTS level 1 regions in Turkey are presented in Table 2.

Between 1963 -1996, whilst Central Anatolia, Aegean, East Marmara and Black Sea and West Anatolia respectively have prominent positions in Turkey's potato production, after 43 years, except Central Anatolia (20.95%), Aegean (3.04%), Middle East Anatolia (0.06%); the shares of all the other regions have dropped. This drop is significant especially in West Anatolia (7.06%), East Black Sea (4.97%) and East Marmara (4.55%). When potato production is examined in respect of periods, this circumstance is more prominent. For the second period; the regions of Central Anatolia (12.77%) and Aegean (3.78%) have increased their shares in Turkey's potato production. Conversely; especially the regions of East Black Sea (4.71%), West Black Sea (3.22%), North East Anatolia (2.93%) and the Mediterranean (2.91%) have dropped their shares in potato production. Another prominent point is the significant drop (5.13%) of potato production in East Marmara Region that has a prominent position (12.92%) in total potato production between the years 1963 -1966. In addition to all these, whilst the shares of Central Anatolian and the Aegean Regions in Turkey's potato production were 38.21% between 1963 -1966, 62.21% in the years 2002 - 2005. The results concerning the potato area sown in respect of NUTS level 1 regions in Turkey are shown in Table 3. The regions of Central Anatolia

Table 2. Potato production in respect of NUTS level 1 region in Turkey.

Code	Regions	Production (%)			Change (%)		
		1963 - 1966	1980-1983	2002 - 2005	Period I	Period II	Total
TR1	Istanbul	0.15	0.07	0.01	-0.08	-0.06	-0.14
TR2	West Marmara	2.24	3.10	1.13	0.85	-1.96	-1.11
TR3	Aegean	14.06	13.32	17.10	-0.74	3.78	3.04
TR4	East Marmara	12.92	7.79	8.37	-5.13	0.58	-4.55
TR5	West Anatolia	11.56	5.26	4.50	-6.29	-0.76	-7.06
TR6	Mediterranean	6.05	6.92	4.01	0.87	-2.91	-2.05
TR7	Central Anatolia	24.15	32.34	45.11	8.18	12.77	20.95
TR8	West Black Sea	7.63	9.72	6.50	2.09	-3.22	-1.14
TR9	East Black Sea	12.05	11.79	7.08	-0.27	-4.71	-4.97
TRA	North East Anatolia	6.72	6.87	3.94	0.16	-2.93	-2.77
TRB	Middle East Anatolia	2.07	2.53	2.13	0.46	-0.40	0.06
TRC	South East Anatolia	0.39	0.29	0.12	-0.10	-0.17	-0.27
	Total	100.00	100.00	100.00	-	-	-

Source: (Anon, 1963-2005).

Table 3. Potato area sown in respect of NUTS level 1 region in Turkey.

Code	Regions	Area sown (%)			Change (%)		
		1963 - 1966	1980 - 1983	2002 - 2005	Period I	Period II	Total
TR1	Istanbul	0.20	0.06	0.01	-0.14	-0.04	-0.19
TR2	West Marmara	2.37	2.77	1.35	0.40	-1.42	-1.02
TR3	Aegean	11.85	10.52	15.82	-1.33	5.30	3.97
TR4	East Marmara	10.73	7.88	8.79	-2.85	0.90	-1.94
TR5	West Anatolia	8.93	7.77	5.06	-1.16	-2.70	-3.86
TR6	Mediterranean	5.69	6.15	4.44	0.45	-1.71	-1.25
TR7	Central Anatolia	22.74	29.03	35.16	6.29	6.13	12.42
TR8	West Black Sea	11.89	9.68	8.27	-2.21	-1.41	-3.63
TR9	East Black Sea	16.39	15.17	11.71	-1.22	-3.46	-4.68
TRA	North East Anatolia	6.17	7.83	5.93	1.66	-1.90	-0.24
TRB	Middle East Anatolia	2.50	2.67	3.15	0.18	0.48	0.66
TRC	South East Anatolia	0.53	0.47	0.30	-0.06	-0.17	-0.23
	Total	100.00	100.00	100.00	-	-	-

Source: (Anon, 1963-2005).

(35.16%), Aegean (15.82%) and East Black Sea (11.71%) have respectively the most important shares in potato area sown between 2002 and 2005. The total share of the mentioned three regions in potato area sown is 62.69%. All the other regions except Central Anatolia (12.42%), Aegean (3.97%) and Middle East Anatolia (0.66%) have dropped their shares in total potato area sown between 1963 - 2005.

Besides, the shares of Central Anatolian and Middle East Anatolia Regions have increased in potato area sown both in two periods. On the contrary, the shares of Istanbul, West Anatolia, West and East Black Sea and South East Anatolia Regions have dropped in potato area sown both in two periods. While the shares of West and East Black Sea Regions in total potato area sown were 28.28% between 1963 -1966, 19.98% was in the years 2002 - 2005. This drop is important especially in the second period. Another important point is the drop in the share of Aegean Region within potato area sown in the first period and of a significant increase (5.30%) in the second period. The results with regard to the productivity of potato according to NUTS level 1 regions in Turkey are presented in Table 4. According to these results; potato productivity in Turkey has increased 38.48% in the first period, 64.75% in the second period and 128.15% in total. Only Central Anatolia and Aegean Regions were above Turkey's average in terms of productivity of potato. The most significant productivity increase was in the

Table 4. Potato yield in respect of NUTS level 1 region in Turkey.

Code	Regions	Productivity (kg./hectare)			Change (%)		
		1963 - 1966	1980 - 1983	2002 - 2005	Period I	Period II	Total
TR1	Istanbul	8 636	18 622	19 877	115.63	6.74	130.17
TR2	West Marmara	11 083	18 146	22 403	63.72	23.46	102.13
TR3	Aegean	13 890	20 535	28 877	47.84	40.63	107.90
TR4	East Marmara	14 105	16 030	25 463	13.65	58.85	80.53
TR5	West Anatolia	15 164	10 996	23 763	-27.49	116.11	56.70
TR6	Mediterranean	12 445	18 245	24 091	46.60	32.04	93.57
TR7	Central Anatolia	12 442	18 067	34 283	45.21	89.75	175.54
TR8	West Black Sea	7 518	16 289	21 008	116.67	28.97	179.44
TR9	East Black Sea	8 612	12 605	16 156	46.37	28.17	87.59
TRA	North East Anatolia	12 755	14 245	17 769	11.68	24.73	39.30
TRB	Middle East Anatolia	9 721	15 350	18 026	57.91	17.43	85.43
TRC	South East Anatolia	8 551	9 906	10 585	15.85	6.85	23.79
	Total	11 713	16 219	26 722	38.48	64.75	128.15

Source: (Anon, 1963-2005).

Table 5. Estimations on Turkey potato production model.

Periods	R^2	α	β_1	β_2	β_3
Total (1963 - 2005)	0.980	-228220.000 (-6.172)	11.888* (26.660)	21.510* (14.650)	982.710 (0.123)
Period I (1963 -1982)	0.974	-153390.000 (-10.42)	11.210* (14.010)	14.290* (33.34)	-12185.000* (-2.088)
Period II (1983 - 2005)	0.983	-219960.000 (-4.538)	10.986* (25.450)	23.527* (9.103)	6864.700 (0.5446)

Source: Original calculations.
*Values in parenthesis are t_c values, 5% statistically significance (t_t = 1.658).

regions of West Black Sea (179.44%), Central Anatolia (175.54%) and Istanbul (130.17%) between 1963 -2005. Where the most significant productivity increase in the Regions of West Black Sea and Istanbul has been in the first period, it has been in the second period in Central Anatolia Region. Besides; whilst West Anatolia was the most productive region in potato between 1963 - 1966, it lost this advantageous position and productivity in the first period has dropped 27.49%. However, potato productivity has increased in the second period with 116.11% in the region. The results regarding the econometric models that determine the potato production in Turkey are presented in Table 5.

According to this, where the most important factor effecting the potato production in the first period is planting areas, in the second term and in the total, it is productivity. It is possible to say that the most important factor in the potato production is the developments in the productivity within 43 years period. On the other hand, though climate was considered to be as tertiary important after planting areas and productivity in the first period, it has been found that climate has no important effect in potato production in total and for the second period. The results with regard to the econometric models that are used to estimate the factors effecting the potato production according to NUTS level 1 regions are presented in Table 6. As it is seen in the table, the most important factors effecting the potato production vary according to regions. In this respect; the most important factor in potato production in Istanbul, West Marmara and North East Anatolia Regions has been found as planting areas, whereas productivity has been in the regions of Aegean, East Marmara, West Anatolia, Mediterranean, Central Anatolia, West and East Black Sea, Middle East Anatolia, South East Anatolia.

DISCUSSION

It is clearly understood that an important structural transformation has been experienced in Turkey's potato production in respect of NUTS level 1 regions between 1963 - 2005 and regional disparities occurred. The mentioned change in potato production is in favor of Central Anatolia and Aegean Regions and against all the other regions mainly the regions of West Anatolia, East Black Sea and Marmara. When potato production and planting areas are taken into consideration according to periods, increase in the potato production for the first period is more than the second period. Though potato area sown

Table 6. Estimations regarding potato production models according to NUTS level 1 region.

Code	Regions	R^2	α	β_1	β_2
TR1	Istanbul	0.70	-925.85 (-2.20)	7.74* (4,53)	1.19* (9.39)
TR2	West Marmara	0.99	-646740.00 (-15.41)	3.58* (19.59)	17.95* (33.49)
TR3	Aegean	0.99	-467590.00 (-17.12)	23.97* (28.10)	20.41* (23.50)
TR4	East Marmara	0.99	-310600.00 (-37.33)	16.76* (41.12)	18.89* (36.81)
TR5	West Anatolia	0.87	-148340.00 (-5.15)	12.82* (12.34)	9.88* (11.21)
TR6	Mediterranean	0.98	-150580.00 (-14.52)	9.11* (27.12)	16.02* (24.18)
TR7	Central Anatolia	0.99	-157430.00 (-9.47)	62.20* (15.59)	27.85* (14.75)
TR8	West Black Sea	0.98	-180300.00 (-10.08)	21.57* (28.25)	8.91* (21.48)
TR9	East Black Sea	0.97	-301280.00 (-10.52)	24.87* (29.33)	11.84* (14.00)
TRA	North East Anatolia	0.98	-207850.00 (-18.04)	13.55* (20.72)	15.44* (38.76)
TRB	Middle East Anatolia	0.96	-34723.00 (-4.93)	4.28* (18.11)	8.55* (11.31)
TRC	South East Anatolia	0.86	-4745.60 (-4.54)	0.71* (12.14)	6.08* (9.63)

Source: Original calculations.
*Values in parenthesis are t_c values, 5% statistically significance ($t_t = 1.671$).

increased in the first period, they dropped in the second period. Conversely, productivity increased significantly in the second period. This situation shows that 185.06% increase in the potato production is because of the increase in planting areas for the first period and productivity increase for the second period between the years 1963 - 2005. Referring to a study by Dağdemir et al. (1999), they explained the same situation in the potato production for the agricultural regions in Turkey between 1963 -1998.

Between 2002 - 2005, first three positions belong to Central Anatolian, Aegean and East Marmara Regions in potato production. For the mentioned years, only the share of Central Anatolian Region in the potato production was 45.11%. This shows that Central Anatolian Region has a relative advantage in potato production when compared with other regions. Respectively, West Black Sea and Central Anatolian Regions have the highest productivity increase in potato production between 1963 - 2005. However, where potato area sown increased in Central Anatolia, they dropped in West Black Sea Region. This shows that researches towards potato productivity in West Black Sea Region have increased significantly but not adequate to compete with Central Anatolia region. Furthermore, it is understood that production of alternative agricultural crops to potato are more profitable. Because, though 179.44% increase in the productivity for Black Sea Region within the mentioned years, the share of the region in the total potato area sown dropped 3.33%. The most important factor in potato production in Istanbul, West Marmara and North East Anatolian Regions is planting areas, whereas productivity is in the regions of Aegean, East Marmara, West Anatolia, Mediterranean, Central Anatolia, West and East Black Sea, Middle East Anatolia, South East Anatolia. The average potato productivity in Turkey between 2002 - 2005 was 26722 kg/ha, whereas average in 15 countries in European Union was 39 487 kg/ha and average of 25 countries were 30 277 kg/ha (Anon, 2005). This shows the low productivity in the regions except Central Anatolia region. Within this circumstance, it is of utmost importance to make policies that by-pass low productivity. Ayyıldız et al. (1997) stated that productivity level in potato production is rather low when compared with European Countries and pointed out the policies increasing productivity. The findings from the researches indicate that especially in the second period, namely the years (1980 -1983) - (2002 - 2005), dissimilar regions had relative advantages in potato production and focused on production of this crop. Yavuz (1998) has indicated that different agricultural regions in Turkey have comparative advantages on different products. Particularly, potato production that is subject to market conditions after 1980 could be seen in the regions where production is lucrative and specialization has occurred spontaneously. It is a must to speed up this process so as to increase the efficiency of the agricultural sources. This could only be achieved by comprehensive researches based on production and effective regional policies.

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