

Decomposition of Income Inequality: Evidence from Turkey

Jacques Silber, Department of Economics, Bar-Ilan University,
Suleyman Ozmucur, Department of Economics, University of Pennsylvania, E-mail:
ozmucur@ssc.upenn.edu

Abstract

This study attempts to determine the impact that various income sources and different population categories in both urban and rural areas had on the overall level of income inequality in Turkey in 1994. Inequality is significantly higher in urban than in rural areas and this difference is mainly the consequence of differences in the Gini Index in both areas rather than being related to differences in population or income shares. It is therefore clear that migration flows from rural to urban areas should lead to an increase in overall inequality in Turkey and this is indeed what has been observed between 1987 and 1994.

1. Introduction

More than forty years ago, in his Presidential Address to the American Economic Association, Kuznets (1955) suggested that income inequality was generally rising in the early stages of economic development. In the latter phases of the development process, inequality declines, he argued, and this hypothesis of an inverted *U* relationship between inequality and development has since been known as the Kuznets Curve. Kuznets (1955) centered his argument on the impact of rural to urban migration flows on the distribution of incomes during the development process. The idea is that "even if within-sector inequality is constant and the ratio of mean sectoral incomes is also constant, the shift of population between sectors at first produces a widening in inequality and then a narrowing" (Adelman and Robinson, 1989). While Kuznets (1955) used a numerical example, Robinson (1976) provided a more rigorous proof of Kuznets' hypothesis and his demonstration was based on the existence of

intersectoral difference in mean income and did not require a higher average income or a greater level of inequality in the growing sector. Fields (1980) considerably extended this approach by making a distinction between a sector enlargement effect, a sector enrichment effect and an interaction terms. More details on this type of model are given in Adelman and Robinson (1989) in their survey of income distribution and development. There have been numerous empirical investigations testing Kuznets' conjecture and in recent years an abundant literature has appeared that tries to give theoretical foundations to Kuznets' proposition (see, Deutsch and Silber, 1999, for a non exhaustive survey of recent theoretical and empirical work on the Kuznets Curve). The present study, though focusing on income inequality and on differences between urban and rural areas in Turkey, is not another attempt to check the validity of Kuznets' thesis. Its much less ambitious goal is to take a look at the most recent data that have been published on the distribution of incomes in Turkey. In particular it tries to estimate the contribution of urban and rural areas to the overall level of inequality in Turkey and attempts to understand the determinants of the difference which exists between income inequality in urban and rural areas. In a period of just seven years, between 1987 (the previous year for which detailed data were available), a time where a majority of the Turkish population lived in rural areas, and 1994, when the majority of the population of Turkey lives in urban areas, tremendous changes seem to have occurred in Turkey. A quick comparison between the distribution of incomes in 1987 and 1994 indicates that income inequality has increased significantly. The Gini index for the distribution of individual incomes was in 1987 equal to 0.44 in urban areas and to 0.33 in rural areas (see, Ozmucur and Silber, 1995; see also Hansen, 1991, Ozbudun&Uluslan, 1980, Ozmucur, 1996, and State Institute of Statistics, 1997 for results on other years). The corresponding figures for 1994 are 0.58 and 0.46. It is certainly of utmost importance to

try understand the factors which led to such increases. We plan indeed to analyze this evolution in future work and this will certainly give us an opportunity to refer to the Kuznets curve. The present study however has a more modest goal in so far as it will take a look at the 1994 data only and try to give a picture of some of the basic characteristics of income inequality in Turkey in 1994.

The paper is organized as follows. Section 2 analyzes the impact of various income sources on overall income inequality while Section 3 looks at the decomposition of inequality by population subgroups (urban versus rural areas, but also by category of workers: Wage and Salary Earners, Daily Workers and Proprietors). Brief concluding comments are given in section 4.

2. The Decomposition of the Gini Index by Income Source:

2.1. The Methodology:

Let X_{ji} denote the value of income source i for individual j and let $X_{.i}$ and $X_{.j}$ be respectively defined as

$$X_{.i} = \sum_{j=1}^n X_{ji} \quad (1)$$

$$X_{.j} = \sum_{i=1}^I X_{ji} \quad (2)$$

where I represents the total number of income sources and n the number of individuals. Let also S_{ji} , $S_{.i}$ and $S_{.j}$ be defined as

$$S_{ji} = X_{ji} / X \quad (3)$$

$$S_{.i} = X_{.i} / X \quad (4)$$

$$S_j = X_j / X \quad (5)$$

where X represents the total income of the population (all sources combined). $S_{.i}$ represents therefore the weight of income source i in total income X while S_j denotes the share of individual j in total income. Following Silber's (1989) analysis of the decomposition of income inequality, it is possible to define the Gini Index I_G of overall income inequality as:

$$I_G = [e'] G [S] \quad (6)$$

where $[e']$ is a 1 by n row vector of population shares, each equal to $(1/n)$, $[S]$ is the n by 1 column vector of the income shares S_j and G is a n by n square matrix whose typical element g_{hk} is equal to 0 if $h = k$, to -1 if $h < k$ and to $+1$ if $h > k$. Notice that in (5) the income shares S_j are ranked by decreasing value of the total income (all sources combined) of the various individuals. Since the share S_j of individual j may also be written as

$$S_j = \sum_{i=1}^I S_{ji} \quad (7)$$

expression (5) may also be written as

$$I_G = e' G [[S_{j1}] + [S_{j2}] + [S_{j3}] + \dots + [S_{ji}] + \dots + [S_{jI}]]. \quad (8)$$

Note that in (8) the terms $[S_{ji}]$ on the R.H.S. of the G-matrix represent, in fact, column vectors whose typical element is equal to S_{ji} . In other words, (8) may be written as

$$I_G = [e'] G \left[\sum_{i=1}^I [S_{ji}] \right] \quad (9)$$

where $[S_{ji}]$ is a n by 1 column vector containing the n shares $S_{ji} (= X_{ji} / X_i)$ of the income source i .

Let now V_{ji} represent the share (X_{ji} / X_i) of individual j in income source i .

Expression (9) may then be written as:

$$I_G = [e'] G \left[\sum_{i=1}^I S_i [V_{ji}] \right] \quad (10)$$

$$I_G = \sum_i S_i \{ [e'] G [V_{ji}] \} = \sum_i S_i H_i = \sum_i C_i \quad (11)$$

where H_i is called the Pseudo-Gini, C_i is the contribution of income source i to overall inequality and $[V_{ji}]$ represents the n by 1 vector of the shares V_{ji} . Remember, however, that in the vector $[V_{ji}]$ the shares V_{ji} are ranked not by decreasing value of the shares (X_{ji} / X_i) but by decreasing values of the share $S_i = (X_i / X)$. The shares V_{ji} may therefore not be monotonically decreasing and this explains why the product $H_i = [e'] G [V_{ji}]$ is called the Pseudo-Gini of income source i . Let $[y_{ji}]$ represent the vector of the shares (X_{ji} / X_i) when the latter are ranked by decreasing values. The product $[e'] G [y_{ji}]$ represents then the Gini Index of inequality of income

source i among the various individuals. Following Silber (1993) and Fluckiger and Silber (1995) and using (10), the index of overall income inequality is written as:

$$I_G = \sum_{i=1}^I S_i [G[y_{ji}]] + \sum_{i=1}^I S_i [G[V_{ji} - y_{ji}]]. \quad (12)$$

The first term on the R.H.S. of (11) is the weighted sum of the values of the Gini index for the various income sources, the weights (S_i) being equal to the share of income source i in the total income in the population. The second term on the R.H.S. of (12) is a permutation component which is equal to the weighted sum of the difference between the values of the Pseudo-Gini and the actual Gini index for the various income sources. This permutation component is therefore a consequence of the fact that the ranking of the different individuals may vary from one income source to the other.

2.2. An Illustration: Turkey in 1994

To illustrate this decomposition technique Table 1 gives the values of the Gini Index and of the Pseudo-Gini for various population categories and income sources, separately for urban and rural areas in Turkey. As a whole it turns out that inequality is higher in urban areas, the Gini index being there equal to 0.58 while its value in rural areas is .46. Such a differential does not however apply to each population category. While among Wage and Salary Earners inequality is higher in urban (a Gini index of .45) than in rural areas (where the Gini index is equal to .40), the converse is true among Daily Workers since for them the Gini index is equal to .40 in urban and .46 in rural areas. Among Proprietors however inequality is again higher in urban (a Gini index of .58) than in rural areas (a Gini index of .45). While the results are quite similar to those which have just been described when one looks at the distribution of the primary source of income, the data

are completely different when one measures the degree of inequality of the distribution of income from secondary jobs or from other sources. It appears that income from a secondary job is very unequally distributed (the Gini indices are in most cases higher than .5 and often higher than .7). This is also true for the distribution of other income sources in urban areas. In rural areas the situation is somehow different because apparently most proprietors have other income sources and they seem to be very equally distributed, the Gini index for this source being equal to .3. While the data of Table 1 give an indication concerning the degree of inequality of the distribution of the various income sources for the different population categories, they do not indicate how important is the contribution of each income source to overall inequality, for a given population category. Such an information is given in Table 1 where for each population category (for each row, that is, urban versus rural areas, and in each case for each of the three types of workers) the contribution of each of the three income sources to overall inequality is given. The data in each row have been computed on the basis of equation (11) above. Remember that in (11) the contribution of each income source i ($i=1$ to 3), is equal to the product of its share in total income times the Pseudo-Gini of this source, whose definition was given previously. If one first compares urban and rural areas, all categories of workers combined, one observes that the relative contribution of the income from a primary job is higher in rural (85%) than in urban areas (71%). Note that this occurs despite the fact that the Gini and Pseudo Gini are higher in urban (.529) than in rural (.464) areas (see, Table 1), because the share of income from a primary job is higher in rural (.847) than in urban (.783) areas. This result however does not hold for all types of workers. Thus the contribution of income from a primary job to overall inequality is higher in urban areas for Wage and Salary Earners and for Daily Workers but higher in rural areas for Proprietors. In each case, as was just explained, one has to

take into account both the share of the income source and the value of the Gini, or rather, the Pseudo-Gini Index. As far as income from a secondary job is concerned, one may note that in almost all the cases (at the exception of the Daily Workers in rural areas), its contribution to overall inequality is small, despite the fact that high values of the Gini and Pseudo Gini indices were generally observed in Table 1. This result is therefore a consequence of the fact that the share in total income of this income source is generally low, whatever the population category concerned. Finally for income from other sources the relative contribution is generally higher in urban areas and for two reasons: the share of this source is usually higher in urban areas and the Gini index has a higher value in urban areas (at the exception of the case of Daily Workers).

Table 1: Gini Index and Pseudo-Gini by Income Source and Population Subgroup

Population Category	All income sources combined (Gini Index)	Income from Primary Job (Gini Index)	Income from Primary Job (Pseudo-Gini)	Income from Secondary Job (Gini Index)	Income from Secondary Job (Pseudo-Gini)	Other Income Sources (Gini Index)	Other Income Sources (Pseudo-Gini)
URBAN AREAS							
Wage and Salary Earners	.452	.410	.410	.784	.778	.638	.634
Daily Workers	.399	.377	.377	.715	.695	.629	.612
Proprietors	.598	.548	.548	.696	.694	.737	.736
Together	.583	.529	.529	.786	.769	.783	.778
RURAL AREAS							
Wage and Salary earners	.400	.346	.346	.693	.692	.562	.562
Daily Workers	.456	.409	.409	.773	.767	.728	.693
Proprietors	.449	.464	.464	.447	.445	.293	.287
Together	.464	.464	.464	.565	.537	.424	.402
URBAN and							

RURAL AREAS combined							
Wage and Salary Earners	.442	.399	.398	.778	.732	.631	.626
Daily Workers	.424	.397	.396	.773	.698	.665	.642
Proprietors	.567	.537	.537	.583	.543	.719	.715
Together	.546	.509	.538	.708	.649	.729	.716

3. The Breakdown of the Gini Index by Population Subgroup:

3.1. The Methodology:

Following earlier studies (see, Bhattacharya and Mahalanobis, 1967, Rao, 1969, Fei, Ranis and Kuo, 1979, Kakwani, 1980, Lerman and Yitzhaki, 1984), Silber (1989) has proven, using the approach based on the G-matrix which was described in Section 2, that the Gini index may be decomposed into three elements: a within populations contribution (I_W), a between populations inequality (I_B), an interaction or overlap component (I_O). If P_a and W_a are the shares in total population and in total income of area a and if I_a refers to the Gini index for area a, Silber (1989) has proven that:

$$I_W = \sum_{a=1 \text{ to } A} P_a W_a I_a \quad (13)$$

where A is the number of areas distinguished. It can also be shown that:

$$I_B = [\dots P_a \dots] G [\dots W_a \dots] \quad (14)$$

where the elements in the row vector $[\dots P_a \dots]$ and in the column vector $[\dots W_a \dots]$ are ranked by decreasing average income (that is by decreasing ratios W_a / P_a) and G is an A by A G-matrix. Finally, the overlap component I_O is defined as:

$$I_O = I_G - (I_W + I_B) \quad (15)$$

where I_G refers to the Gini index for the country as a whole.

Table 2: Absolute and Relative Contribution (given in parantheses) to Total Inequality (Gini Index) of various income sources

Population Category	Income from Primary Job	Income from Secondary Job	Income from Other Sources	Value of Gini Index
URBAN AREAS				
Wage and Salary Earners	0.342 (0.756)	0.030 (0.065)	0.081 (0.178)	0.452
Daily Workers	0.343 (0.860)	0.014 (0.035)	0.042 (0.106)	0.400
Proprietors	0.401 (0.671)	0.023 (0.038)	0.174 (0.291)	0.597
Together	0.414 (0.711)	0.027 (0.046)	0.142 (0.242)	0.583
RURAL AREAS				
Wage and Salary Earners	0.279 (0.701)	0.069 (0.171)	0.051 (0.128)	0.400
Daily Workers	0.349 (0.766)	0.058 (0.126)	0.049 (0.108)	0.456
Proprietors	0.397 (0.888)	0.027 (0.060)	0.023 (0.052)	0.448
Together	0.393 (0.847)	0.038 (0.081)	0.033 (0.072)	0.464
URBAN and RURAL AREAS together				
Wage and Salary Earners	0.330 (0.747)	0.037 (0.084)	0.074 (0.168)	0.442
Daily Workers	0.355 (0.836)	0.024 (0.058)	0.045 (0.106)	0.424
Proprietors	0.421 (0.742)	0.024 (0.043)	0.122 (0.215)	0.568
Together	0.409 (0.750)	0.031 (0.056)	0.106 (0.194)	

3.2. An Illustration based on Turkish data (1994):

Such a decomposition is presented in Table 3, separately for urban and rural areas.

There are striking differences between the two cases. As indicated earlier inequality is higher in urban (the Gini index being equal there to 0.583) than in rural areas (where the Gini index is .464), but the relative importance of the three components which were just mentioned is not the same. In urban areas the most important component is the between categories inequality (the categories referring to the three types of workers: Wage and Salary Earners, Daily Workers and Proprietors) since it represents 51% of the overall inequality while in rural areas the between categories inequality corresponds only to 21% of the total inequality and is much smaller than the within categories inequality which represents 41% of the total inequality (the corresponding share in urban areas is 33%). Note also that the degree of overlap is both in absolute

and relative terms more important in rural than in urban areas: in rural areas it is equal to 0.103, which corresponds to 22% of the overall inequality, whereas in urban areas it is equal to 0.090, representing only 15% of total inequality. Concerning the within groups inequality one may also observe that in urban areas the Gini index is highest among Proprietors but the most important contribution to within categories inequality is that of the Wage and Salary Earners (53% of the total within groups inequality) because of their high share (56%) in the total urban population. In rural areas on the contrary the Gini index is highest (.456) for Daily Workers (a value in fact very close to that of the Gini Index for Proprietors (.449) but the highest contribution to within groups inequality is that of Proprietors (91%), because of the importance of this category in the total rural population and because it earns the highest income in rural areas.

Table 3: Decomposition of Inequality by Population Category within Urban and Rural Areas

Type of Inequality and Population Category	Share in Population	Share in Income	Value of the Gini Index	Contribution to Within Categories Inequality
URBAN AREAS				
Within Categories Inequality				
Wage and Salary earners	0.563	0.401	0.452	0.102
Daily Workers	0.164	0.060	0.399	0.004
Proprietors	0.272	0.539	0.598	0.088
Weighted Within Categories Gini Index			0.194	0.194
Between Categories Gini Index			0.299	
Overall Gini Index			0.583	
Measure of Overlap			0.090	
RURAL AREAS				
Within Categories Inequality				
Wage and Salary earners	0.241	0.206	0.400	0.020
Daily Workers	0.116	0.042	0.456	0.002
Proprietors	0.643	0.751	0.449	0.217
Within Categories Gini Index			0.239	0.239
Between Categories Gini Index			0.122	
Overall Gini Index			0.464	
Measure of Overlap			0.103	

4. Concluding Comments:

This study has been essentially of a descriptive nature in so far as we attempted to determine the impact that various income sources (income from the primary job, from a secondary job and from other sources) and different population categories (Wage and Salary Earners, Daily Workers and Proprietors) in both urban and rural areas had on the overall level of income inequality in Turkey in 1994. However the observations we made may allow us to start understanding what the migration flows from rural to urban areas imply. Let us first summarize some of the basic data. First inequality is significantly higher in urban than in rural areas. Moreover the analysis at the end of the

paper has indicated that this difference in inequality is mainly the consequence of differences in the Gini Index in both areas rather than being related to differences in population or income shares. It is therefore clear that migration flows from rural to urban areas should lead to an increase in overall inequality in Turkey and this is indeed what has been observed between 1987 and 1994. A second type of observations concerns the relative importance of the three contributions to overall inequality: the between groups, the within groups and the overlap components. In rural areas the main component is the within categories inequality while in urban areas it is the between categories. Moreover Proprietors represent the main category in rural areas while Wage and Salary Earners are the most important group in urban areas. Note also that the “richest” category in both rural and urban areas is that of the Proprietors while Wage and Salary Earners, in both areas, are the “second richest” (or the “second poorest” since only three categories were distinguished). Migration from rural to urban areas is therefore likely to imply also that many of these migrants who were originally Proprietors become now Wage and Salary Earners. Since Proprietors in urban areas are much richer than Wage and Salary Earners and given that the between categories inequality is the most important component of overall inequality in urban areas, the migration flows from rural to urban areas are also likely to imply an increase in this between groups inequality (in urban areas). Third the analysis of the role of income sources has shown that income from primary job is by far the main source of income in rural areas. In urban areas this also true for Wage and Salary Earners and Daily Workers but income from other sources represents here an important source of income for Proprietors. Since the analysis in terms of the elasticity of overall inequality with respect to the various income sources indicated that this elasticity was generally positive for primary income and negative for other income sources, decreasing overall inequality in Turkey may require taxing the other income

sources in urban areas, especially that of Proprietors in urban areas for whom this source represent 24% of their total income. But one should be careful before making such a policy recommendation. An important issue concerns the exact nature of these other income sources in urban areas. In a study of income inequality in Turkey in 1987 Ozmucur and Silber (1995) had found that in urban areas, Wage and Salaries represented 29%, Entrepreneurial Income 38% and Rent 16% of total income, the rest corresponding mainly to transfers. The question therefore is to know whether taxing other income sources in urban areas would imply hurting entrepreneurial income. If that is the case, such a measure is likely to have an negative impact on economic growth, a side effect which may be considered as very counter-productive. More work is therefore needed before drawing solid policy implications.

Bibliography

- Adelman, I. and S. Robinson, "Income Distribution and Development," in H. Chenery and T.N. Srinivasan, eds., *Handbook of Development Economics*, Volume II, Amsterdam: Elsevier Science Publishers, 1989, 951-1003.
- Bhattacharya, N. and B. Mahalanobis, "Regional Disparities in Consumption in India," *Journal of the American Statistical Association*, 62 (1967).
- Boratav, K., *100 Soruda gelir Dagilimi (Kapitalist Sistemde, Turkiye'de ve Sosyalist Sistemde)*, Gercek Yayınevi, Istanbul, 1969.
- Bulutay, T., S. Timur, and H.Ersel, *Turkiye'de Gelir Dagilimi, 1968*, Ankara Universitesi Siyasal Bilgiler Fakultesi Yayinlari No: 325, Ankara.
- Cavusoglu, T. and Y. Hamurdan, *Gelir Dagilimi Arastirmasi, 1963*, Devlet Planlama Teskilati Yayin No. 500. Ankara.
- Celasun, M., "Income Distribution and Employment Aspects of Turkey's Post 1980 Adjustment", *METU Studies in Development*, 16 (1989), 1-31.

- Deutsch, J. and J. Silber, "The Kuznets Curve and the Impact of Various Income Sources on the Link Between Inequality and Development," mimeo, 1999.
- Devlet Istatistik Enstitüsü, *1987 Hanehalki Gelir Ve Tuketim harcamalari Anketi Sonuclari- Gelir Dagilimi*, Devlet Istatistik Enstitüsü Yayin No. 1441, Ankara, 1990.
- Devlet Istatistik Enstitüsü, *1994 Hanehalki Gelir Dagilimi Anketi Sonuclari*, Devlet Istatistik Enstitüsü Yayin No. 2051, Ankara, 1997.
- Devlet Planlama Teskilati, *Gelir Dagilimi, 1973*, Devlet Planlama Teskilati Yayin No. 1495, Ankara, 1976.
- Fei, J. C. H., S. W. Y. Kuo and G. Ranis *Growth with Equity: The Taiwan Case*, Oxford University Press, 1979, New York.
- Fields, G.S., *Poverty, Inequality and Development*, New York: Cambridge University Press, 1980.
- Fluckiger, Y. and J. Silber "Income Inequality Decomposition by Income Source and the Breakdown of Inequality Differences Between Two Population Subgroups", *Swiss Journal of Economics and Statistics*, 131, 1995, pp 599-615.
- Hansen, B. *The Political Economy of Poverty, Equity and Growth*, World Bank Comparative Studies, Oxford University Press, 1991
- Kakwani, N. C. *Income Inequality and Poverty: Methods of Estimation and Policy Applications*, Oxford University Press, Oxford, 1980.
- Kuznets, S., "Economic Growth and Income Inequality," *American Economic Review* 65 (1955):1-28.
- Lerman, R. and S. Yitzhaki "A Note on the Calculation and Interpretation of the Gini Index", *Economics Letters*, 15, 1984, pp 363-368.
- Lerman, R. and S. Yitzhaki "Income Inequality Effects by Income Source: A New Approach and Applications to the United States", *Review of Economics and Statistics*, 67, 1985, pp 151-156.
- Lerman, R. and S. Yitzhaki "Effect of Marginal Changes in Income Sources on U.S. Income Inequality", *Public Finance Quarterly*, 22, 1994, pp 403-417.

- Ozbudun, E. and A. Uluhan, eds. *The Political Economy of Income Distribution in Turkey*, Holmes and Meier Publishers, New York and London, 1980.
- Ozmucur, S. *Turkiye'de Gelir Dagilimi, Vergi Yuku ve Makroekonomik Gostergeler*, Bogazici Universitesi Yayinlari, Istanbul, 1996.
- Ozmucur, S. and J. Silber "Income Inequality Decomposition by Area of Residence (rural versus urban areas) and Income Source: The Case of Turkey in 1987", mimeo, 1995.
- Rao, C. R., "Two Decompositions of the Concentration Ratio," *Journal of the Royal Statistical Society*, Series A, 132 (1969).
- Robinson, S., "A Note on the U Hypothesis Relating Inequality and Economic Development," *American Economic Review* 66 (1976): 437-440.
- Silber, J. "Factor Components, Population Subgroups and the Computation of the Gini Index of Inequality", *Review of Economics and Statistics*, 71, 1989, pp 107-115.
- Silber, J., "Income Decomposition by Income Source: A Note," *Review of Economics and Statistics* LXXV (1993): 545-547.
- Yitzhaki, S. "On the Progressivity of Commodity Taxation", in W. Eichhorn, editor, *Models and Measurement of Welfare and Inequality*, Springer-Verlag, Heidelberg, 1994, pp 448-465.
- Yitzhaki, S. "A Critique of Poverty Measurement," Discussion Paper A96.02, The Maurice Falk Institute of Economic Research, Jerusalem, 1997.

Appendix. Income Distribution in Turkey, 1963- 1994

	1963	1968	1973	1987	1994
lowest 20%	4.5	3.0	3.5	5.2	4.9
second 20%	8.5	7.0	8.0	9.6	8.6
middle 20%	11.5	10.0	12.5	14.1	12.6
fourth 20%	18.5	20.0	19.5	21.2	19.0
top 20%	57.0	60.0	56.5	49.9	54.9

Gini coefficient	0.55	0.56	0.515	0.437	0.492
------------------	------	------	-------	-------	-------

Sources: Cavusoglu & Hamurdan (1966), Bulutay, Serim, Timur (1970), Devlet Planlama Teskilati (1976), Devlet Istatistik Enstitusu (1990, 1997)