GINI DECOMPOSITION BY GENDER: TURKISH CASE

Ezgi Kaya* and Umit Senesen

Universitat Autònoma de Barcelona
International Doctorate in Economic Analysis
08193 Bellaterra–Barcelona, Spain

Istanbul Technical University
Faculty of Management
34367 Macka–Istanbul, Turkey

ABSTRACT

The aim of this paper is to reveal the gender inequalities in income distribution for Turkey by using decomposition of Gini coefficient, a common income inequality measure. A new decomposition method, Dagum's approach for decomposition of the Gini coefficient is used in the study. In the analysis, the decomposition of the Gini coefficient by gender is applied to Turkish individuals twice. First Gini coefficient for total disposable income is decomposed to examine the gender disparities in individual income distribution. Here disposable income inequality is examined on the basis of female–male, illiterate–primary–secondary–tertiary education levels, urban–rural areas, agricultural–non-agricultural sectors. Second, Gini coefficient for wage-income is partitioned to its components to define wage gap between males and females. The wage-income inequality is also examined on the basis of gender, education levels, urban–rural areas, as well as public, private and state economic enterprises (SEE). The data used here are the incomes of Turkish individuals and come from 2005 Household Budget Survey conducted by Turkish Statistical Institute (TURKSTAT). The decomposition of Gini coefficient presented that the contribution of inequalities between genders is more influential in income distribution than in wage-income distribution and the portion of inequality between genders in other income factors to the total income inequality is more than it is in wage-income. Lastly, another class of decomposable income inequality measures, generalized entropy indexes are decomposed by gender and the differences between Gini decomposition and generalized entropy indexes are examined.

Key words: Gini coefficient, decomposition, income distribution, gender.

Jel Classification System-Numbers: D63, D31, J16, J71.

* Corresponding author: kayaez@idea.uab.es

I. INTRODUCTION

The aim of this paper is to reveal the gender inequalities in income distribution for Turkey. There is limited number of empirical studies on the topic and most of them investigate the gender based wage inequalities in the labour market (Ilkkaracan ve Selim, 2007, Kara, 2006, Tansel, 2005, Dayioglu ve Tunali, 2004, Dayioglu ve Kasnakoglu, 1997). In this study the two methods, namely entropy indexes and Dagum's decomposition of Gini coefficient, are compared and it is shown that the latter is preferable. Then applying the decomposition method on the Turkish data several types of income inequalities are compared with the gender inequality. Afterwards gender inequalities in each of the income categories are analyzed

This approach is consistent with the traditional scientific research method used in social sciences which rely on comprehensive databases and quantitative methods. Certain "gender studies" express that these methods are mostly developed by males and the quantitative data they use are criticized for not reflecting exactly or not taking into consideration the issues of concern to women (Gunluk-Senesen, 1998, p.26). Feminist researchers, propose that the main databases, national household surveys, especially in developing countries, take households as units which generate "male-biased analysis and policies" and do not allow considering gender disparities and mostly ignore women (Berik, 1997, p.122). For this reason some feminist researchers prefer to use qualitative, rather than quantitative, methods in "gender studies" and believe that qualitative methods reflect human experiences better (Jayaratne, 1983, p.109). However this approach limits the studies on women's social statue and it is difficult to compare the results because of a little use of quantitative methods. Since social and economic policies are closely linked with data and systematic methods, these limitations cause the outcomes of these valuable works to be ignored (Gunluk-Senesen, 1998, p.26). As Berik indicated that "there is no distinctive feminist method, but rather there are feminist application of methods and that the research question rather than the method should drive the research" (1997, p.122). When the use of quantitative method considered as an important and effective tool for policy makers, the qualitative methods used in "gender studies" should be supported by the objective and statistical methods in order to be taken serious in social and economic policy recommendations (Jayaratne, 1983, p.112).

In this paper with the use of quantitative data and traditional method, it is expected to make a contribution to studies on women's social status. For this purpose, Section II gives a brief history on entropy indexes and decomposition of most widely used income inequality measure in economics, Gini coefficient, Section III analyses a new decomposition method developed by Dagum and can be considered a methodology section. Section IV compares the findings of Gini decomposition and entropy indexes. Section V examines the role of gender played in income and wage inequalities in Turkey by decomposing Gini coefficient. Finally Section VI summarizes the results.

II. A BRIEF HISTORY

For any inequality measure, decomposability of a whole to constituent parts is an essential property to bring out the sources of inequality. For a long time, a widely used income inequality measure, Gini coefficient, is thought to be non-decomposable and discussions carried on the class of decomposable income inequality measures. However the close link between Gini coefficient and Lorenz curve made Gini coefficient popular among many researchers and led them to work on Gini decomposition.

The initial research on income inequality decomposition is Soltow's 1960 work, in that he analyzed the effects of changes in education, age and occupation on income distribution (Mussard et al., 2005, p.2). The important step in decomposition literature is a new income inequality measure developed by Theil in 1967 and derived from the Second Law of Thermodynamics (Dagum, 1997, p.515). Entropy Law measures the shares of "between and within-groups inequalities" in total inequality (Theil, 1967, p.19). Theil allocated fourth chapter of his book to his entropy index and it's decomposition by race and region based on US data (pp. 91–134). In the same year Bhattacharya and Mahalanobis used Theil's decomposition method to decompose Gini coefficient. This study, where Bhattacharya and Mahalanobis used the term "Gini's mean difference" for determining regional disparities in income distribution, is attributed as the first attempt of Gini decomposition (Dagum, 1997, p.516). "Gini's mean difference" is the arithmetic average of absolute differences of the all income pairs (Sen, 1997, p.31).

In one of his studies that provide a different perspective in decomposition of income inequality measures literature, Rao (1969, p.418) proposed two different procedures to decompose an income inequality measure, by subpopulation or by income source. These two different procedures demonstrated the main difference between Gini coefficient and entropy indexes in the decomposability debate (Mussard et al., 2005, p.2). Gini coefficient's decomposition gives an extraordinary between-group component as it includes the differences between all income pairs, whereas traditional two-term method consists of within and between inequalities, applied as in the generalized entropy class of measures (Mussard et al., 2005, p.2). Since Gini coefficient derived from the mean difference which is the average of absolute differences of all income pairs, it can overestimate the contribution of the between-group inequalities to the total inequality. However generalized entropy class of measures, which include Theil index, compute between-group component of inequality simply over the income differences of group means (Mussard et al., 2005, p.2).

The common definition of the generalized entropy indexes adopted as decomposable in the literature is given by:

$$I^{\beta} = \frac{1}{\beta(\beta+1)n} \sum_{j=1}^{k} \sum_{i=1}^{n_j} \frac{y_{ij}}{\mu} \left[\left(\frac{y_{ji}}{\mu} \right)^{\beta} - 1 \right] \tag{1}$$

Theil (T), Hirschman-Herfindahl (H-H) and Bourguignon (B) indexes are the particular cases of generalized entropy class of measures (Mussard et al., 2003, p.2). When β tends towards zero Equation 1 gives Theil index:

$$T = \lim_{\beta \to 0} I^{\beta} = \frac{1}{n} \sum_{j=1}^{k} \sum_{i=1}^{n_j} \frac{y_{ji}}{\mu} \log \frac{y_{ji}}{\mu}. \tag{2}$$

H-H index is the particular case of generalized entropy measures when β tends towards one in the general definition:

$$I^{1} = \lim_{\beta \to 1} I^{\beta} = \frac{1}{2n} \sum_{j=1}^{k} \sum_{i=1}^{n_j} \frac{y_{ji}}{\mu} \left(\frac{y_{ji}}{\mu} - 1 \right). \tag{3}$$

Dagum, demonstrate that Bourguignon's index is another special case of generalized entropy class of measures when β tends towards –1 (Mussard at al., 2003, p.3). Then, Bourguignon index is defined as t follows where M_g is the geometric mean of the population:

$$B = \lim_{\beta \to -1} I^{\beta} = \log \mu - \log M_g. \tag{4}$$

Before passing on to Dagum's Gini decomposition, it would be helpful to mention the decomposition of generalized entropy indexes to understand the main difference between the decomposition of Gini coefficient and this class of measures.

Generalized entropy indexes are decomposed into two components, within and between-group contributions:

Within-group contribution: $$I^{\beta w} = \sum_{j=1}^{k} \frac{n_j \mu_j}{n\mu} \left(\frac{\mu_j}{\mu} \right)^{\beta} I_{\beta wj} , \qquad (5)$$

Between-group contribution: $$I^{\beta b} = \frac{1}{\beta(\beta+1)} \sum_{j=1}^{k} \frac{n_j}{n} \frac{\mu_j}{\mu} \left[\left(\frac{\mu_j}{\mu} \right)^{\beta} - 1 \right]. \qquad (6)$$

Then, generalized entropy indexes are defined as the following sum of these two components:

$$I^{\beta} = I^{\beta w} + I^{\beta b}. \qquad (7)$$

It can be said that Bourguignon's 1979 article made the most important and influential contribution on decomposability, in which he defined the decomposable income inequality measures (Dagum, 1997, p.516). According to Bourguignon, a decomposable income inequality measure is "a measure such that the total inequality of a population can be broken down into weighted average of the inequality existing within subgroups of the population and the inequality existing between them" (1979, p.902). In 1980 Shorrocks defined "the class of additively decomposable measures" in his article where he agreed with the conclusion of Bourguignon. According to this classification Shorrocks defined "additively decomposable measures" as weighted sum of subpopulations inequalities and inequalities between groups' mean differences (1980, p.613) and decided that the generalized entropy indexes are the only class of income inequality measures that have the unbiased decomposability property (1984, p.1383). After Bourgoignon and Shorrocks, Mookherjee and Shorrocks's presentation of "interaction affect" in Gini decomposition, that is caused by differences in mean income and overlap incomes of the different groups, and their conclusions (Mookherjee & Shorrocks, 1982, p.888) made latter researchers to believe Gini is not a good decomposable income inequality measure (Mussard at al., 2005, p.2).

In the following years, important contributions to income inequality decomposition context were made by Cowell (1980), Cowell and Kuga (1981), Frosini (1989) and Shorrocks (1984). Despite the belief of non-decomposability of Gini coefficient, its use is widened as an income inequality measure in the literature and it made another group of researchers to concentrate on the decomposition of Gini, such as Pyatt (1976), Rao (1969), Das and Parikh (1982), Lerman and Yitzhaki (1985), Silber (1989), Yitzhaki (1994).

The base of the conflict on the decomposability of an inequality measure is the identification of between-group inequalities, and can be considered as a problem of measuring distances between distributions (Gertel et al., 2002, p.4). Measuring the distance between two distributions means identifying the income inequalities between income distributions. To simplify, let us assume that population is consist of two subpopulations with equal variances. In Figure 1 the distance between two non-overlapping distributions (P_h and P_j) can be identified by calculating the ratio of total difference, the sum of absolute differences between the incomes of the lower-mean income distribution (P_h) and incomes of the higher-mean income distribution (P_j), to number of total observations or directly taking the difference of mean incomes.

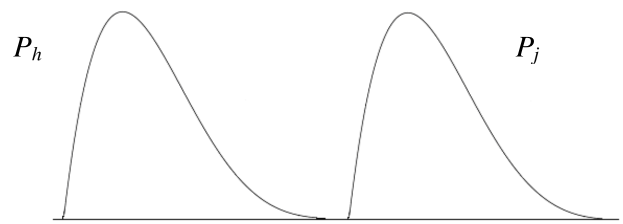


Figure 1. Two non-overlapping income distributions

However if the two distributions overlap as in Figure 2, while defining the distance between them, there is an allocation problem of the incomes in the overlapping area. In Figure 2, in the areas indicated as I and III pose no problem, since the differences between observations in higher-mean income group (P_j) and lower-mean income group (P_h) are indisputably positive.

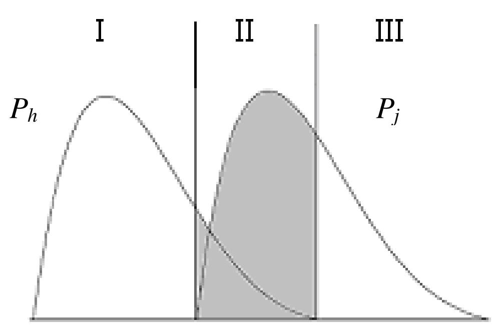


Figure 2. Overlapping income distributions

However in area II some observations in P_j have lower incomes than some of the observations in P_h and vice versa. This causes an overestimation of the average of absolute differences between two groups. Consequently, there is a probability of an allocation error in area II.

In 1997, Dagum criticised the former decomposition methods and claimed that between-group inequality would not be a good statistical measure when it is derived from group means (Dagum, 1997, p.516). According to Dagum this decomposition method, which finds within-and between-group inequalities computed using group means, makes “oversimplification”. The two-term decomposition method does not take the cases into consideration in which income distributions are not normally distributed with unequal variances and ignores the incomes in the overlapping area of two distributions (Dagum, 1997, p.515). Since income distributions are not normally distributed and do not have equal variances, Theil’s (1967) and Bhattacharya and Mahalanobis’s (1967) method of decomposition, which is very similar to one-way analysis of variance, is inappropriate. As a consequence, deriving between-group inequalities from group means is not a proper method for income distributions which differ in variance and asymmetry. Therefore Dagum suggested a decomposition method for Gini coefficient in three components, *Gini inequality within subpopulations* (G^w), *the net contribution of the extended Gini inequality between subpopulations* (G^{nb}) and *the contribution of the intensity of transvariation between subpopulations* (G^t) and proved that Gini coefficient is decomposable when this method is used.

III. DAGUM’S GINI DECOMPOSITION[1]

In this section Dagum’s decomposition approach for Gini coefficient, which covers the contributions of all income units to inequality, will be discussed.

For this purpose let y_i ($i = 1,\ldots, n$) shows income units in the population P of size n. The cumulative income function, mean income and Gini coefficient of P are symbolized as $F(y)$, μ and G respectively. If population P is partitioned into k groups according to their socioeconomic properties (gender, education, region, etc.) and n_j is the size and μ_j ($j = 1,\ldots, k$.) is the mean income of the j-th group (P_j) respectively, then Gini coefficient for P is given by:

$$G = \frac{\sum_{i=1}^{n} \sum_{r=1}^{n} |y_i - y_r|}{2n^2 \mu}. \tag{8}$$

Gini coefficient for the subpopulation P_j (within Gini coefficient) is:

$$G_{jj} = \frac{\sum_{i=1}^{n_j} \sum_{r=1}^{n_j} |y_i - y_r|}{2{n_j}^2 \mu_j}, \tag{9}$$

[1] See Dagum (1980), Dagum (1997), Mussard (2005), Mussard et al. (2003, 2005), Dagum (2006).

and between-group Gini coefficient that measures the inequality between two subpopulation is;

$$G_{jh} = \frac{\sum_{i=1}^{n_j} \sum_{r=1}^{n_h} \left| y_{ji} - y_{hr} \right|}{n_j n_h (\mu_j + \mu_h)} . \tag{10}$$

The weights are the population share and the income share for the subpopulation P_j and defined as follows:

$$p_j = \frac{n_j}{n} \text{ and } s_j = \frac{n_j \mu_j}{n\mu} . \tag{11}$$

The income units in the overlapping area of the two distributions are the main reason for using group means in the former methods to calculate the contribution of between-group inequality and the source of the belief in the literature that Gini is not decomposable. Dagum defined two concepts for these units of intersection area.

The first one, *gross economic affluence* between j-th and h-th groups, is defined as,

$$d_{jh} = \int_0^\infty dF_j(y) \int_0^y (y-x) dF_h(x) \qquad \forall \ \mu_j > \mu_h . \tag{12}$$

where $\mu_j > \mu_h$ and $y_{ji} > y_{hr}$. This term uses the differences between all income pairs x_{ij} - x_{rh} only for each x_{ij} of j-th group is higher than x_{rh} of h-th group given that j-th group's mean income is higher than h-th group's mean.

The second concept is the *first-order moment of transvariation* that shows the income differences between j-th and h-th groups, where $\mu_j > \mu_h$ and $y_{ji} < y_{hr}$.

$$p_{jh} = \int_0^\infty dF_h(y) \int_0^y (y-x) dF_j(x) \qquad \forall \ \mu_j > \mu_h . \tag{13}$$

This term, contrary to the previous one, is computed over the differences between all income pairs x_{ij}-x_{rh} only for each x_{rh} of h-th group is higher than x_{ij} of j-th group given that j-th group's mean income is higher than h-th group's mean.

According to these two concepts, the normalized measure of the distance between two subpopulations, *relative economic affluence,* is defined as follows:

$$D_{jh} = \frac{(d_{jh} - p_{jh})}{(d_{jh} + p_{jh})} \tag{14}$$

The values of D_{jh} lie in the interval [0, 1]. It equals one when the two probability density functions do not overlap and it becomes zero when the two distributions are identical. In other words, when the two distributions get away from each other, D_{jh} tends towards one. In this case the *net between-group Gini coefficient* is:

$$G^{nb} = \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} D_{jh} (p_j s_h + p_h s_j) . \tag{15}$$

G^{nb} measures the inequality in the non-overlapping area of j-th and h-th groups' income distributions. This component is the expression of net contribution of between-groups inequality to total income inequality.

The contribution of intensity of transvariation between-groups G^t, is the second component of the Gini coefficient and shows the inequality computed from the overlapping area of the j-th and h-th groups:

$$G^t = \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} (1 - D_{jh})(p_j s_h + p_h s_j) \tag{16}$$

G^t demonstrates the inequalities between income pairs in the overlapping area of subpopulations' income distributions. The sum of *net between-group Gini coefficient* and *the contribution of intensity of transvariation between-groups* give the *gross between-group Gini coefficient*.

$$G^{gb} = G^{nb} + G^t \tag{17}$$

Thus, between-group income inequality measure G^{gb} is derived from all income units not just from the income means as it is in the decomposition of generalized entropy indexes. The third and the last component is *within-group Gini coefficient* G^w and defined as follows:

$$G^w = \sum_{j=1}^{k} G_{jj} p_j s_j \tag{18}$$

Consequently, Gini coefficient is decomposed by groups as:

$$G = G^w + G^{gb} \tag{19}$$

Finally, for a population P with n income units n_j (j = 1,…,k), which is partitioned in k subpopulations, the Gini decomposition in three terms can be shown as:

$$G = G^w + G^{nb} + G^t \tag{20}$$

In this Gini decomposition method, total Gini coefficient is equal to sum of the three components and the interpretation of the components is rather easy.

IV. GENERAL FINDINGS

Analyses in this section are based on the data given by 2005 Household Budget Survey of Turkish Statistical Institute (TURKSTAT). 2005 Household Budget Survey is conducted on a total of 720 (monthly) and 8640 (annually) sample households that changed every month and selected by stratified two-stage clustered sampling method in overall Turkey for a period between January 1 and December 31, 2005. Household budget surveys cover not only variables of household and consumption expenditures but also variables related to individuals' demographic characteristics (age, gender, and education level), employment variables (occupations, economic activity, labour status) in the survey month and during previous year.

Table 1a and 1b present the information necessary to decompose Gini coefficient. As it is seen in Table 1a, all individuals who have a yearly disposable income in 2005 Household Budget Survey are included in the analyses. The mean income for these 13485 individuals is 7668,088 YTL and the Gini coefficient for this distribution is 0,473.

Table 1.a. Yearly personal disposable income by gender (YTL)

Gender	Sample size (n_j)	Mean income $(\bar{y}_j)$	Subpopulation share (p_j)	Income share (s_j)	Gini coefficient (G) Within G_{jj}	Gini coefficient (G) Between G_{jh}	Relative economic affluence (D_{jh})
Female	3717	4660,157	0,276	0,168	0,533	0,528	0,584
Male	9768	8812,691	0,724	0,832	0,437		
TOTAL	13485	7668,088	1,000	1,000	0,473		

According to Table 1b the mean wage-income of the 6193 individuals over 12 years of age and economically active is 7160,768 YTL and the wage-income Gini coefficient is 0,418. In this case the relative economic affluence between genders is statistically significant both in disposable income distribution and wage-income distribution at 0,01 significance level. As mentioned before, relative economic affluence is related to the economic units in the overlapping area. According to the findings, the economic distance between genders is higher in personal disposable income distribution than it is in wage-income distribution. In other words, in disposable income distribution inequalities between genders make higher contribution to total inequality than it does in wage-income.

Table 1.b. Yearly total wage-income by gender (YTL)

Gender	Sample size (n_j)	Mean income ($\bar{y}_j$)	Subpopulation share (p_j)	Income share (s_j)	Gini coefficient (G) Within G_{jj}	Gini coefficient (G) Between G_{jh}	Relative economic affluence (D_{jh})
Female	1366	5446,138	0,221	0,168	0,481	0,453	0,371
Male	4827	7645,994	0,779	0,832	0,397		
TOTAL	6193	7160,768	1,000	1,000	0,418		

The decomposition of Gini coefficient computed[2] from Table 1a and 1b is given in Table 2. Although the Gini coefficients for disposable income and wage-income are very similar, the decomposition results reveal that the net inequality between genders is more evident in disposable income distribution.

Table 2. Gini decomposition by gender for disposable income and wage-income

	G^w	G^{gb}: G^{nb}	G^{gb}: G^t	G
Disposable income	0,288	0,108	0,077	0,473
Wage-income	0,276	0,053	0,089	0,418

The findings in Table 2 can be interpreted as follows. The Gini coefficient for Turkey derived from individual level disposable income distribution is 0,473. This indicates a high income inequality. One of the important factors in this inequality is gender. The contribution of the gender inequality to the total Gini coefficient is 0,108 + 0,077 = 0,185. In percentage terms it is a little higher than 0,185 / 0,473 = % 39, i.e. nearly 2/5.

If a similar analysis done for the wage-income distribution, total Gini coefficient is 0,418. This also indicates a high inequality in wage distribution. The contribution of the gender inequality to the total inequality is 0,053 + 0,089 = 0,142. The percentage representation of this is nearly % 34, a little more than 1/3. In other words the effect of inequalities between genders in other factors of income to the total income inequality is more than it is in wage-income.

[2] For the software used see Mussardat et. al. (2002).

Finally Table 3a and 3b, which compare Gini decomposition and generalized entropy indexes, show the percentage share of each component. As it is seen all generalized entropy indexes, computed from income means, show similar results, but cannot give any information about the contribution of intensity of transvariation between females and males.

Table 3.a. Contributions of each component of the indexes to the overall income inequality (%)

Index	Within-group inequality	Between-group inequality	Contribution of the intensity of transvariation
G	60,85	22,85	16,30
T	92,41	7,59	-
H-H	96,03	3,97	-
B	93,90	6,10	-

Table 3.b. Contributions of each component of the indexes to the overall wage inequality (%)

Index	Within-group inequality	Between-group inequality	Contribution of the intensity of transvariation
G	65,95	12,64	21,41
T	97,15	2,85	-
H-H	97,71	2,29	-
B	97,76	2,24	-

These generalized entropy measures are not adequate for two reasons. First, they consider only the mean incomes of groups rather than incomes of all economic units; as a result they miss some important details. Second, they have no means of determining the contribution of the intensity of transvariation, which is part of between-group disparities stemmed from the overlapping of two income distributions. Therefore generalized entropy measures tend to underestimate the between-group inequalities.

It can be seen in Table 3 that each of the generalized entropy indexes shows less than 10 % contribution of between-group inequality for males and females. The amount of contribution is between 4,0 % and 7,5 % for disposable income distribution, and even less for wage-income distribution (2,2 – 2,8 %). However Dagum's method for Gini decomposition draws a different conclusion. The effect of gender disparities computed from Gini decomposition is 5 – 10 times of contributions for disposable income as it is derived from entropy indexes and 12 – 15 times for wage-income.

V. COMPARISONS

In the earlier part of this section we will first report our findings on relative economic affluence and their contingency coefficients on several classifications based on gender, education levels, areas and sectors, once for disposable income and once for wage-income. Then the similar figures between genders will be displayed for several income components. In the later part Gini decompositions of disposable income and wage-income based on similar categories as before and gender decompositions of several income components.

The findings on relative economic affluence are summarized for disposable income in Figure 3a and for wage-income Figure 3b. The lengths of the top nine lines in Figure 3a represent, in terms of disposable income, the relative economic affluence between the demographic categories written on the same line at their left. So the lowest relative economic affluence is between urban and rural populations, the highest is between illiterates and college graduates, i.e. the income differences are smallest between urban and rural classification and largest between illiterates and university graduates. The relative economic affluence for gender is in the middle of these nine lines. That is to say the income discrepancy for gender is more severe than urban–rural discrepancy and the discrepancies of literate people at several education levels. On the other hand gender discrepancy is less severe than it is for agricultural and non-agricultural sectors and between illiterates and people at several levels of education.

The lower eight lines express the effect of gender discrepancy in each type of demographic categories. It is highest in agricultural sector, and then comes rural area and it is followed by secondary education level.

In Figure 3b similar comparisons are displayed for wage-income this time. It is interesting to note that gender discrepancy plays a lesser role on inequality in wage-income distribution than all the other demographic categories on the top 11 lines.

Gender plays a small role in the inequality of wage-income distribution in public sector. It is most influential among primary school graduates and illiterates, followed by private sector wage-earners.

It can be said that in general the role of gender discrepancy is more evident in disposable income distribution than it is in wage-income distribution.

Disposable Income

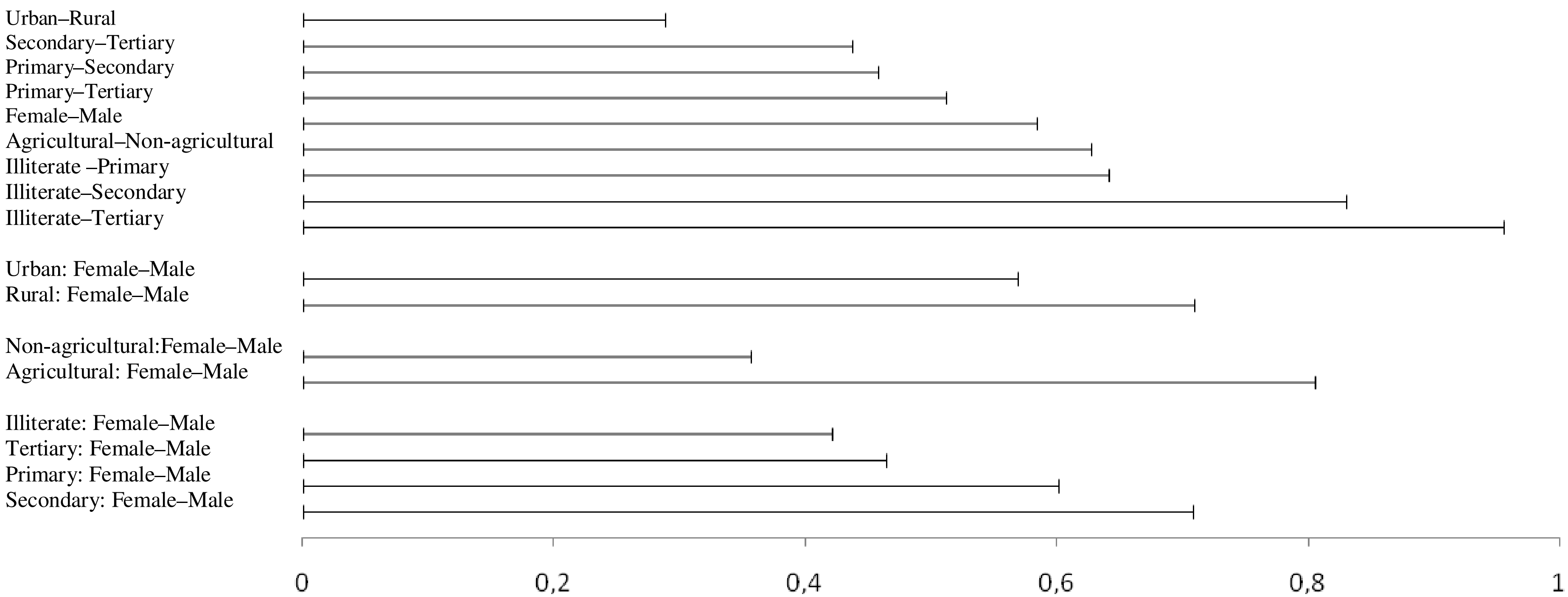


Figure 3.a: Relative economic affluence for disposable income (*D*)

Wage-income

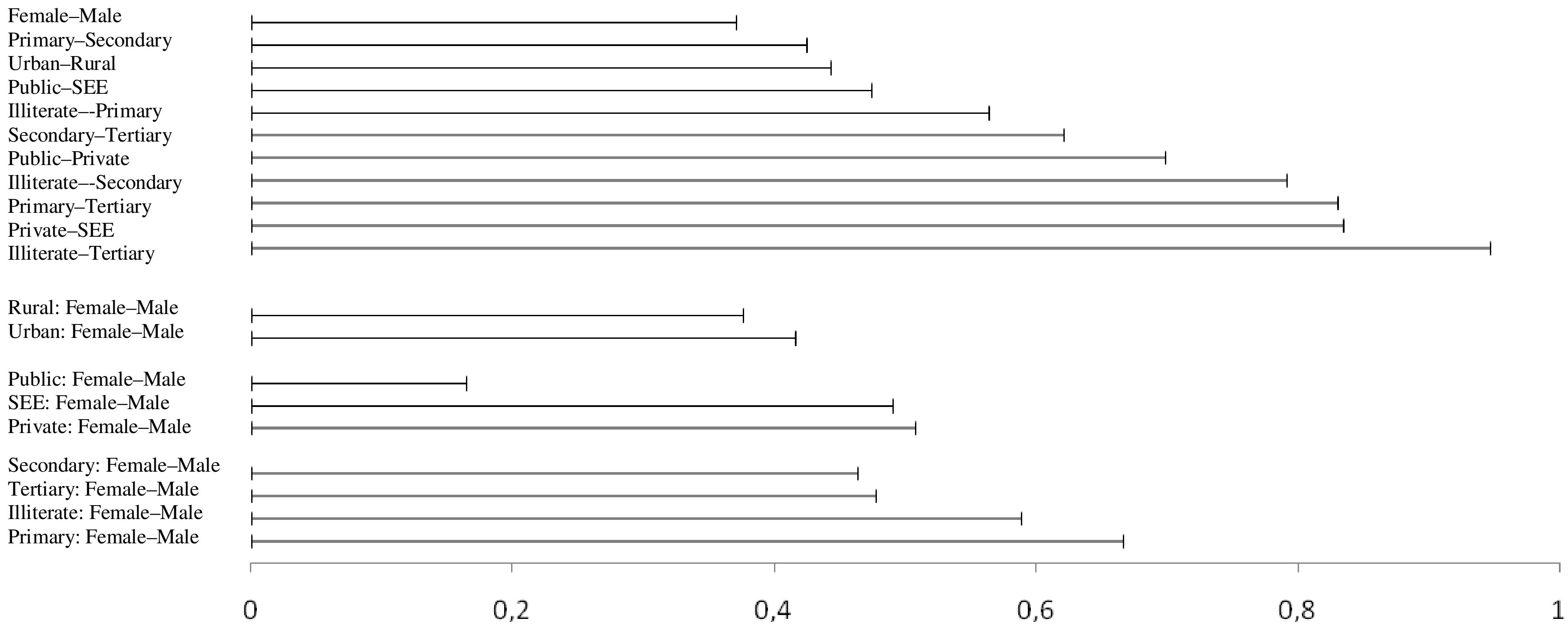


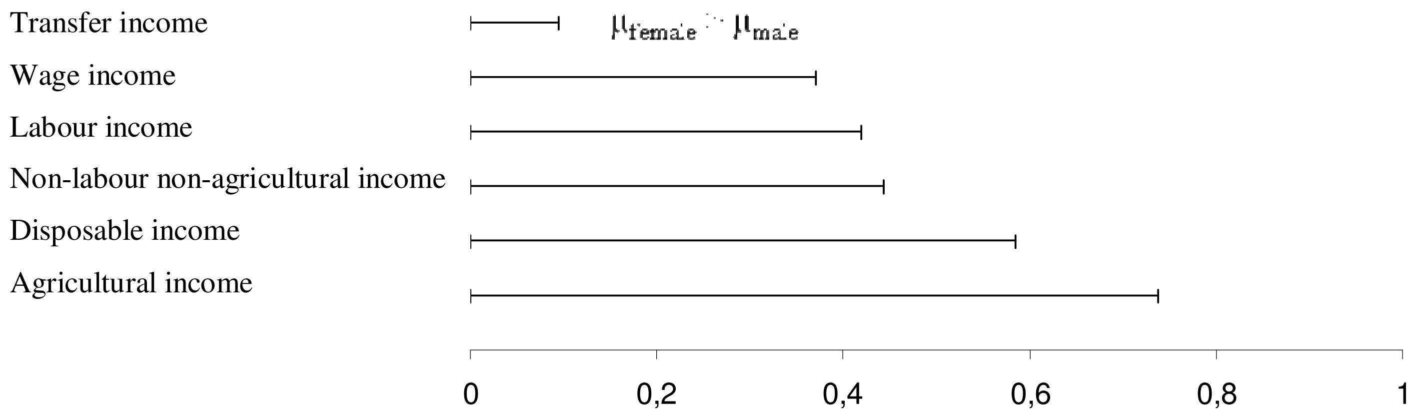
Figure 3.b: Relative economic affluence for wage-income (*D*)

The findings about relative economic affluence between genders for disposable income and its various components are summarized in Figure 4. Figure 4a reveals that the highest gender discrepancy is in agricultural income. It is higher than that of disposable income itself. Then comes non-labour non-agricultural income which is further classified into entrepreneurship income and ownership income in Figure 4b. The gender gap is not statistically significant in ownership income. It is surprising to see that in transfer income the position of females is better than that of males. It is the only exception to the fact that mean income for females is always lower than the mean income for males in every component of income but it should be added that, since relative economic affluence is so small in this case that the two transfer income distributions for males and females are almost completely overlapped.

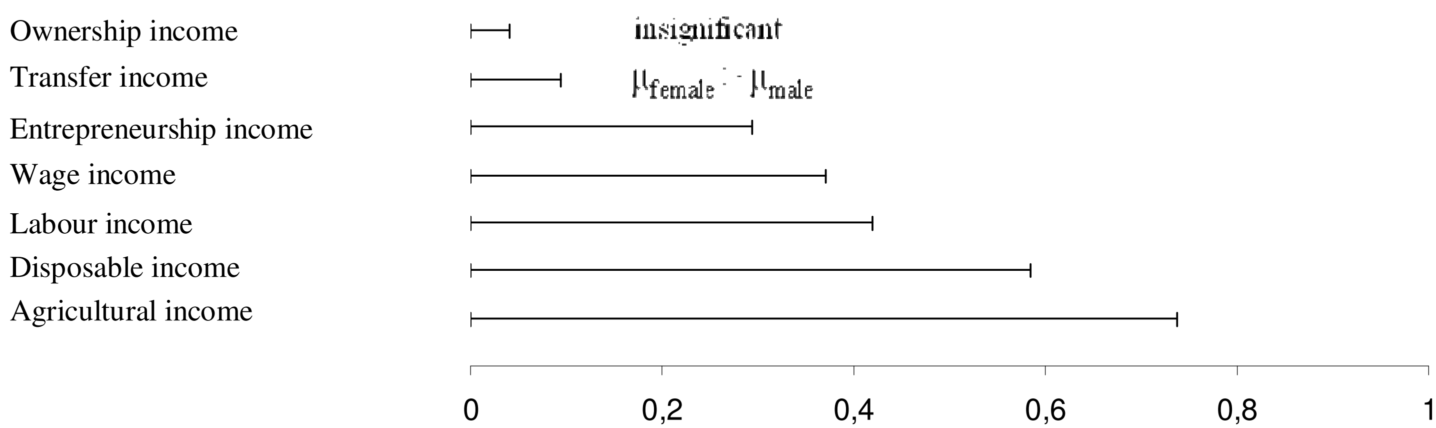
In Table 4a relative economic affluence figures (D) for each comparison are depicted as well as the results of a test proposed by Dagum. It is an approximate test (Kolmogorov-Smirnov one-sided two-sample D^+ statistics) for testing statistical significance of relative economic affluence (1980, p.1798). For large samples, Kolmogorov-Smirnov D^+ statistics converges to the chi-square distribution with two degrees of freedom (Dagum, 2006, 3402):

$$\frac{4n_r n_s (D^+)^2}{(n_r + n_s)} \to \chi^2_{(2)} \qquad (21)$$

The significance levels of these χ^2 values are obtained from the statistical tables and contingency coefficients are calculated. Both were displayed in the same table. All χ^2 values, except one belonging to gender discrepancy for SEE which has very small number of observations anyway, are statistically significant at 0,001 level. The contingency coefficients, which indicate the power of the effect of the discrepancy, are higher for larger relative economic affluent figures as expected. The highest of them (0,69) for both disposable income and wage-income distributions, is between illiterates and university graduates. It is also high for agricultural–non-agricultural discrepancy in disposable income and between private and public sectors wage earners for wage-income. It can be noted that the gender discrepancy is highly powerful in agricultural sector, among primary and secondary school graduates and in rural areas for disposable income and among illiterates and primary school graduates in wage-income.



(a)



(b)

Figure 4: Relative economic affluence between genders for various income components (*D*)

Table 4.a: Relative economic affluence (*D*) and contingency coefficient (*C*)

	D	n_j	n_h	χ^2	*C*
Disposable income					
Female–Male	0,584	3717	9768	3673,10**	0,46
Urban–Rural	0,289	3983	9502	937,63**	0,25
Agricultural–Non-agricultural	0,627	1408	1551	1160,55**	0,53
Illiterate–Primary	0,641	1050	8622	1538,36**	0,37
Illiterate–Secondary	0,831	1050	2480	2037,64**	0,60
Illiterate–Tertiary	0,956	1050	1333	2147,19**	0,69
Primary–Secondary	0,458	8622	2480	1616,03**	0,36
Primary–Tertiary	0,512	8622	1333	1210,59**	0,33
Secondary–Tertiary	0,438	2480	1333	665,31**	0,39
Illiterate: Female–Male	0,421	684	366	169,03**	0,37
Primary: Female–Male	0,708	1977	6645	3055,06**	0,51
Secondary: Female–Male	0,602	610	1870	666,76**	0,46
Tertiary: Female–Male	0,464	446	887	255,58**	0,40
Rural: Female–Male	0,710	212	1091	357,93**	0,46
Urban: Female–Male	0,569	1154	3734	1141,65**	0,44
Agricultural: Female–Male	0,806	274	1134	573,44**	0,54
Non-agricultural: Female–Male	0,356	127	1424	59,11**	0,19
Wage income					
Female–Male	0,371	1366	4827	586,19**	0,29
Urban–Rural	0,443	1303	4888	807,57**	0,34
Public–SEE	0,474	1415	46	40,04**	0,16
Public–Private	0,699	1415	4730	2128,68**	0,51
Private–SEE	0,835	4730	46	127,05**	0,16
Illiterate–Primary	0,564	1050	8622	1190,97**	0,33
Illiterate–Secondary	0,792	1050	2480	1850,87**	0,59
Illiterate–Tertiary	0,947	1050	1333	2106,96**	0,69
Primary–Secondary	0,424	8622	2480	1385,00**	0,33
Primary–Tertiary	0,831	8622	1333	3189,03**	0,49
Secondary–Tertiary	0,621	2480	1333	1337,39**	0,51
Illiterate: Female–Male	0,589	77	95	59,02**	0,51
Primary: Female–Male	0,666	627	2899	914,62**	0,45
Secondary: Female–Male	0,463	345	1213	230,32**	0,36
Tertiary: Female–Male	0,477	317	618	190,69**	0,41
Rural: Female–Male	0,376	952	3031	409,68**	0,31
Urban: Female–Male	0,416	2765	6737	1357,04**	0,35
Private: Female–Male	0,508	1052	3678	844,41**	0,39
Public: Female–Male	0,164	308	1107	25,92**	0,13
SEE: Female–Male	0,490	6	40	5,01*	0,31

**0,001 significance level
*0,10 significance level

Table 4b gives relative economic affluence between genders for various income components as well as corresponding χ^2 values and their contingency coefficients. The most significant gender discrepancy is in agricultural income in terms of both relative economic affluence and contingency coefficient. The same discrepancy is also powerful in disposable income distribution.

Table 4.b: Relative economic affluence between genders for various income components (D) and contingency coefficent (C)

	D	n_j	n_h	χ^2		C
Disposable income	0,584	3717	9768	3673,10	**	0,46
Wage income	0,371	1366	4827	586,19	**	0,29
Labour income	0,419	1598	5561	871,70	**	0,33
Non-labour non-agricultural income	0,444	600	3339	401,06	**	0,30
Ownership income	*0,042*	*477*	*2108*	*2,74*		*0,03*
Entrepreneurship income	*0,295*	*127*	*1421*	*40,58*	**	*0,16*
Agricultural income	0,737	267	1120	468,43	**	0,50
Transfer income	0,095	2342	6173	61,29	**	0,08

** significant at 0,001 level

So far we have dealt with the relative economic affluence values but now we can turn our attention to the decomposition of Gini coefficient. Figure 5a shows Gini decomposition of disposable income. The total length of each line represents the size of Gini doefficient for the related discrepancy in disposable income distribution. Each of the three parts of the line corresponds to the components of Gini coefficient: the leftmost part up to the black point is net between-group Gini coefficient, the middle part between black dot and plus sign is the contribution of intensity of transvariation between-groups and the rightmost part is within-group Gini coefficient. The same applies to Figure 5b which display similar information for wage-income distribution.

When the gender discrepancy is compared with the other discrepancies in terms of net between-group Gini coefficient it comes just after agricultural–non-agricultural sectors but it has stronger influence than the urban–rural and several education levels discrepancies.

However both agricultural and non-agricultural sectors are also heavily affected by the gender discrepancy itself as can be seen on the seventh and eighth lines in Figure 5a.

Disposable Income

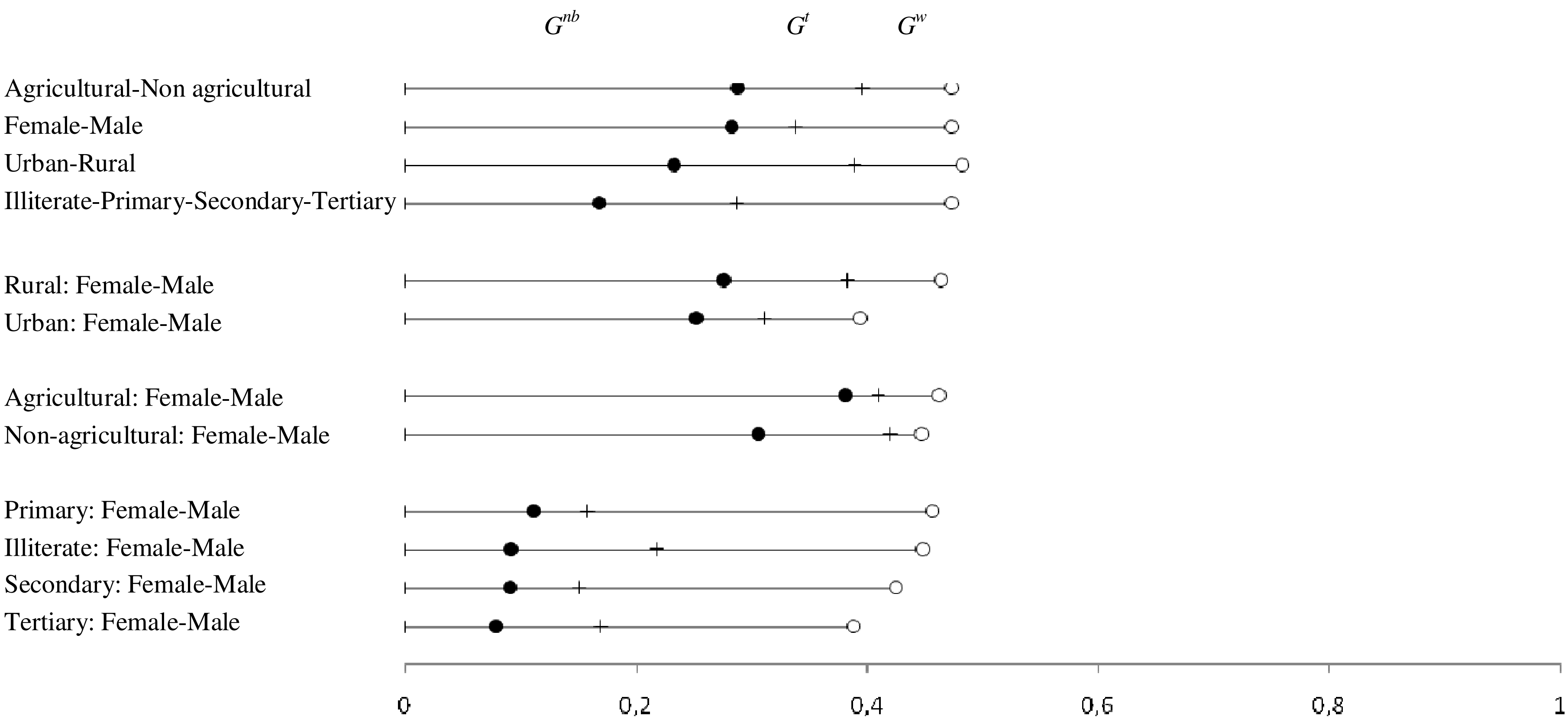


Figure 5.a: Gini decomposition of disposable income

Wage income

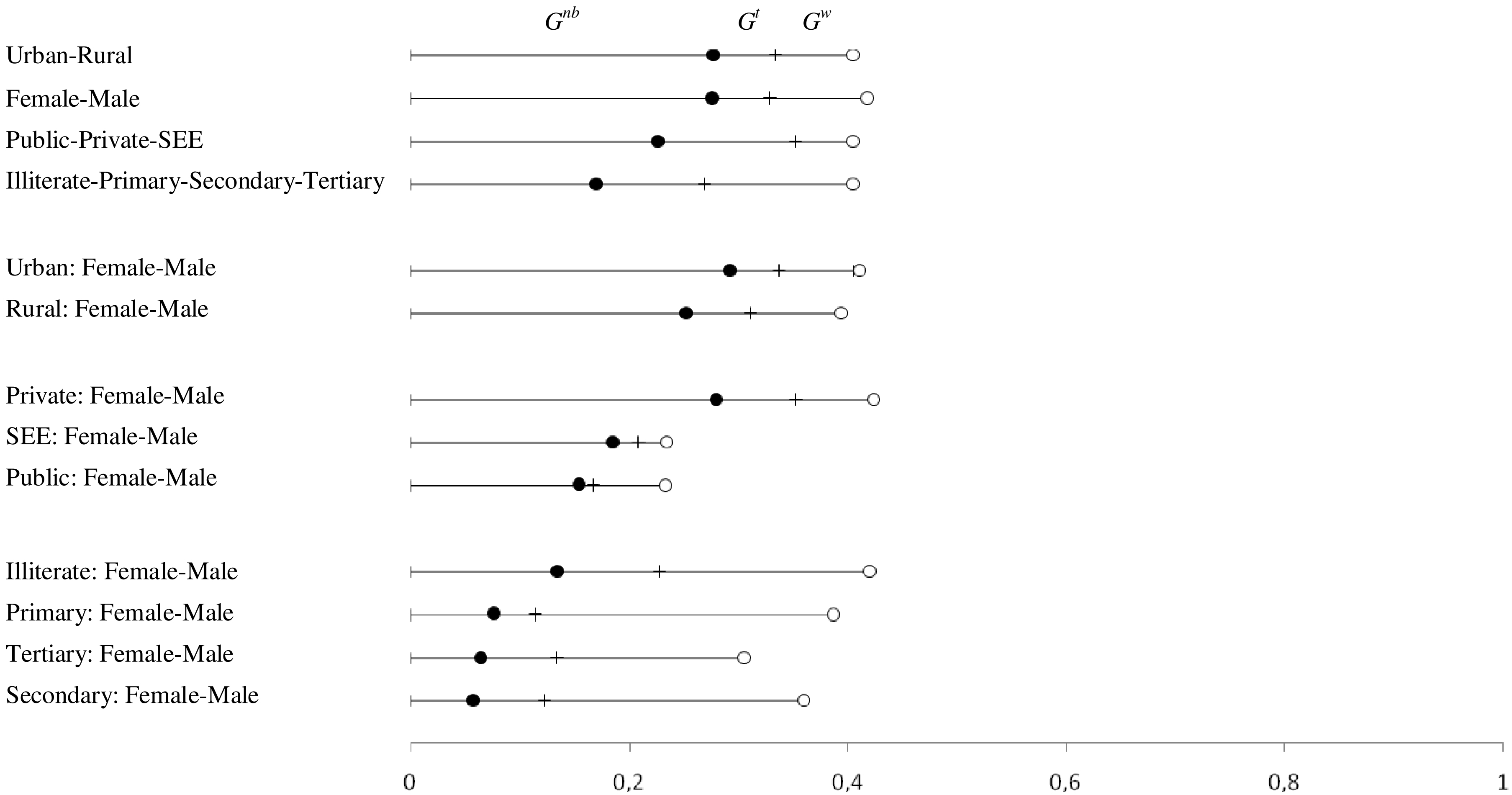


Figure 5.b: Gini decomposition of wage income

According to Figure 5b gender discrepancy in overall wage-income is almost as much influential as urban–rural discrepancy in terms of net-between groups Gini coefficient. Gender discrepancy in urban and rural areas and also in private sector has highly strong effects on the inequality of wage-income distributions in each of these categories. This gender effect gets smaller in various education levels, the weakest being among secondary school graduates.

Figure 6 displays Gini decomposition of various income components by gender. It seems that the net between groups (and also gross between-groups) Gini coefficients are rather small in almost all income components. It means that gender discrepancy loses its power when we move into the components of income. Nevertheless it can be said that it has the highest value in agricultural sector and the lowest value in transfer income which includes various subcategories such as child benefit, unemployment pay, pension payments, scholarships for students, etc.

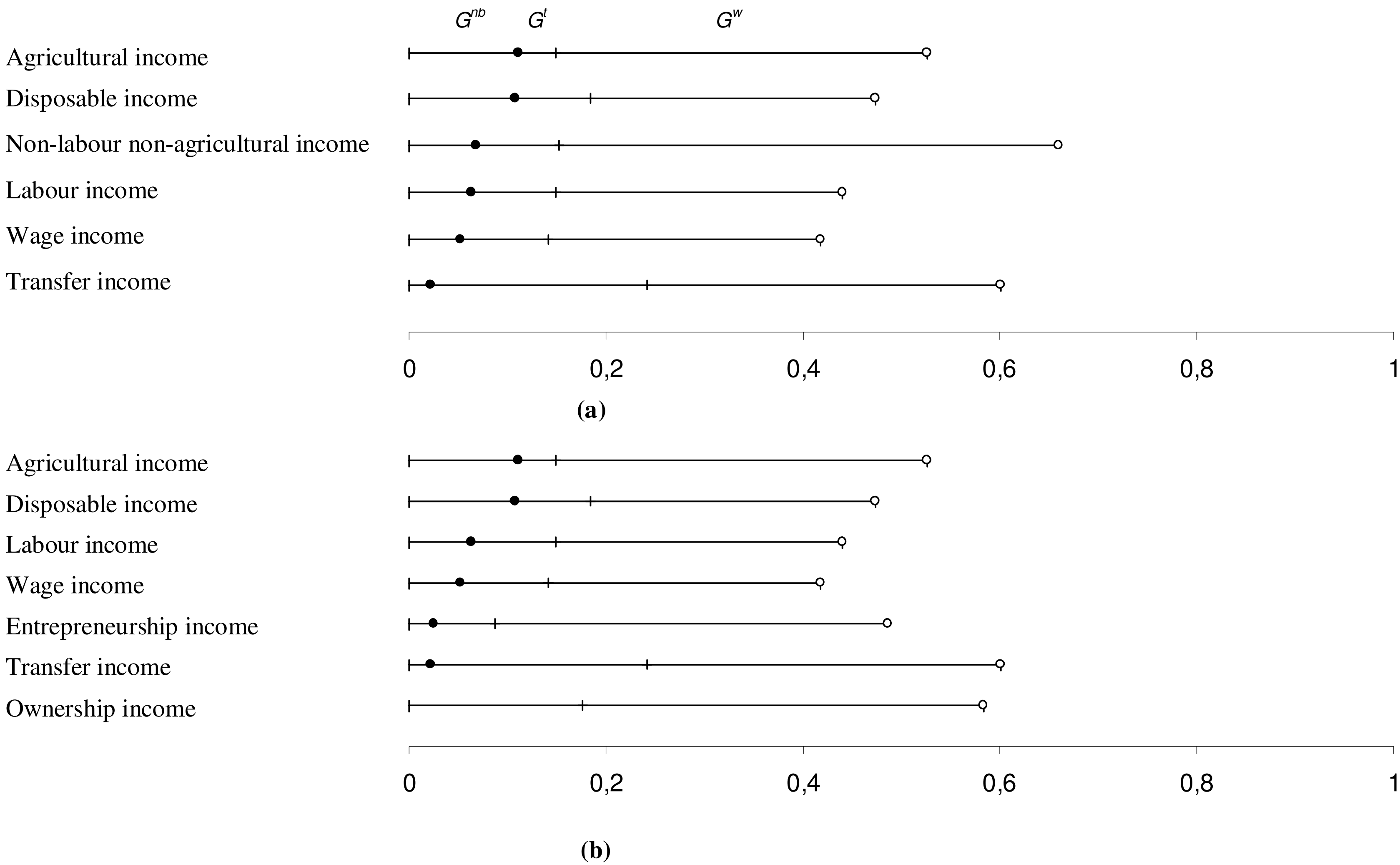


Figure 6: Gini decomposition of various income components by gender

VI. RESULTS

It can be seen in the analysis given above that the gender discrepancy plays an important role in income distribution in Turkey. It constitutes a rather large chunk of Gini coefficient for both disposable income and wage-income distributions, the first having a considerably higher share than the latter. The influence of gender discrepancy is almost as high as the discrepancy between agricultural and non-agricultural sectors. On the other hand agricultural sector, which has almost equal numbers of female and male workers in Turkey, is influenced by income inequality caused by female–male discrepancy itself.

According to our findings private sector, as compared to public sector, has a more powerful income inequality based on gender discrepancy.

When considering to design policies to lessen the income differences between females and males it is hoped taht the findings of this paper might help to the policy makers in Turkey.

Since Dagum's method of decomposition of Gini coefficient is rather new, there is no other comparable study, as far as we know, in any other country so we did not have any opportunity for cross-country comparisons. For the same reason, it was also impossible to compare our findings for any earlier study for Turkey..

References

Berik, G. (1997) "The need for crossing the method boundaries in economics research", *Feminist Economics*, **3 (2),** 121-125.

Bhattacharya, N. & Mahalanobis, B. (1967) "Regional disparities in household consumption in India", *Journal of American Statistical Association*, **62**, 143-161.

Bourguignon, F. (1979) "Decomposable income inequality measures", *Econometrica,* **47**, 901-920.

Cowell, F. A. (1980) "On the structure of additive inequality measures", *Review of Economic* Studies, **47**, 521-531.

Cowell, F. A. & Kuga, K. (1981) "Additivity and the entropy concept: an axiomatic approach to inequality measurement", *Journal of Economic Theory*, **25**, 131-143.

Das, T. & Parikh, A. (1982) "Decomposition of inequality measures and a comparative analysis", *Empirical Economics*, **7**, 23–48.

Dagum, C. (1980) "Inequality measures between income distributions with applications", *Econometrica*, **48**, 1791-1803.

Dagum, C. (1997) "A new approach to the decomposition of the Gini income inequality ratio", *Empirical Economics*, **22**, 515-531.

Dagum, C. (2006) "Income inequality measures", in S. Kotz, N. Balakrishnan, C. B. Read, B. Vidakovic & N. L.Johnson (eds.) *Encyclopedia of Statistical Sciences, Second Edition,* John Wiley vol.5, 3387-3405.

Dayioglu M. & Kasnakoglu Z. (1997) "Kentsel kesimde kadın ve erkeklerin işgücüne katılımları ve kazanç farklılıkları [Women's labour force participation and earnings differentials between genders in Turkey]", METU Studies in Development, 24 (3), 329–361 (in Turkish).

Dayioglu M. & Tunali, I. (2004) "Falling behind while catching up: changes in the female–male differential in urban Turkey, 1988 to 1994", *EALE/SOLE 2005*, Unpublished Paper.

Frosini, B.V. (1989) "Aggregate units, within-group inequality and the decomposition of inequality measures", *Statistica,* **49 (3)**, 349-369.

Ilkkaracan, I. & Selim, R. (2007) "The gender wage gap in the Turkish labour market", *Labour*, **21 (3)**, 563-593.

Gertel, H., R. Giuliodori, R. & Rodriguez, A.F. (2002) "Does schooling contribute to increase individuals' chances to access the more affluent income groups?", *XXXVII Reunion Anual de la AAEP*, November, 2002.

Günlük-Şenesen, G. (1998). "Cinsiyete dayalı ayrımcılığın düzeyi nasıl ölçülebilir? [How to measure gender discrimination level?]", *İktisat Dergisi*, **377**, 26-36 (in Turkish).

Jayaratne, T. E. (1983) "The value of quantitative methodology for feminist research", in Gloria Bowles & Renate Duelli Klein (eds.), *Theories of women's studies*, Routledge and Kegan Paul, 140-162.

Kara, O. (2006) "Occupational gender wage discrimination in Turkey", *Journal of Economic Studies,* **33 (2)**, 130-143.

Lerman, R. I. & Yitzhaki, S. (1984) “A note on the calculation and interpretation of the Gini index”, *Economics Letters*, **15**, 363-368.

Mookherjee, D. & Shorrocks, A. (1982) “A decomposition analysis of the trend in UK income inequality”, *Economic Journal*, **92**, 886-902.

Mussard, S., Seyte, F. & Terraza, M. (2002) Program for Dagum’s Gini decomposition, http://www.lameta.univ-montp1.fr/online/gini.html.

Mussard, S., Seyte, F. & Terraza, M. (2003) “Decomposition of Gini and the generalized entropy inequality measures”, *Economics Bulletin*, **4**, 1-6.

Mussard, S., Alperin, P. M. N., Seyte, F. & Terraza, M. (2005) “Extensions of Dagum’s Gini decomposition”, Working Paper 05-07, Département d'Économique de la Faculté d'administration à l'Université de Sherbrooke.

Pyatt, G. (1976) “On the interpretation and disaggregation of Gini coefficient”, *Economic Journal*, **86**, 243-25.

Rao, V.M. (1969) “Two decompositions of concentration ratio”, *Journal of the Royal Statistical Society*, Series A **132**, 418-425.

Shorrocks, A.F. (1980) “The class of additive decomposable inequality measures”, *Econometrica*, **48**, 613-625.

Shorrocks, A.F. (1984), “Inequality decomposition by population subgroups”, *Econometrica* **53**, 1369-1386.

Sen, Amartya K. (1997) *On Economic Inequality, Expanded edition with a substantial annexe by James E. Foster and Amartya Sen*, Clarendon Press.

Silber, J. (1989) “Factor components, population subgroups and the computation of the Gini index of inequality”, *Review of Economics and Statistics,* **71**, 107-115.

SIS (2005) Household Budget Survey 2005, Statistical Institute of Turkey.

Tansel, A. (2005), “Public-private employment choice, wage differentials and gender in Turkey”, *Economic Development and Cultural Change,* **53 (2)**, 453-477.

Theil, H. (1967) *Economics and Information Theory,* North Holland Publishing.

Yitzhaki, S. (1994) “Economic distance and overlapping of distributions”, *Journal of Econometrics*, **61**, 147-159.