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Decomposition of Inter-Industry Wage Inequality for the U.S. and Turkey

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ABSTRACT

*This paper compares inter-industry wage inequality in the U.S. and Turkish manufacturing sectors by taking into account market structure. Using NBER and TurkStat databases, we calculate the Theil inequality index for the aggregate U.S. and Turkish manufacturing sectors. In addition, we classify the two manufacturing sectors into four subgroups within the context of market structure and examine the contribution of each industry to total wage inequality using the Theil inequality index and entropy decomposition analysis. The results of this study can be summarized as follows: i) Wage inequality increased for both the U.S. and Turkish manufacturing industries. The rise in wage inequality for the Turkish manufacturing industry is larger than for the U.S. manufacturing industry. ii) Wages of production workers contributed more to total wage inequality than did wages of non-production workers for both the U.S. and Turkey. iii) Competitive industries contributed more to the overall wage inequality for the U.S., whereas in Turkey, it was the opposite.***

Keywords: Wage inequality, market structure, Theil index

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I. Introduction

Many researchers have looked at wage inequality in the U.S. and tried to explain it using different factors such as gender, race, level of education, training and skills, technological change, the skill-biased technological change (SBTC) hypothesis, (Card and DiNardo (2002), and found that technological changes and the SBTC hypothesis are not helpful in explaining the rise of wage inequality in the U.S.), demand and supply of skilled/unskilled workers, organizational and institutional changes, and numerous other factors. Yet no research, to our knowledge, has linked wage inequality to the market structure of the U.S. or the Turkish economy. This is the focus of this paper. In this paper, we look at the inter-industry wage inequality in the manufacturing sector and relate it to its market structure in two countries: the United States and Turkey. The reason for choosing the U.S. and Turkey is to compare a developed country with a developing country. In addition, the data is available for these two countries.

The U.S. and Turkish manufacturing sectors differ in many areas. On one hand, the U.S. manufacturing sector is more competitive than the Turkish manufacturing sector. On the other hand, the U.S. manufacturing sector specializes in capital-intensive and highly productive industries, whereas the Turkish manufacturing sector specializes in labor-intensive and less productive industries. This difference is common between developed and developing countries.

Using data from the National Bureau of Economic Research (NBER) and TurkStat, we calculate the inter-industry wage inequality for the U.S. and Turkish manufacturing sectors using the Theil inequality index. Then, using entropy decomposition analysis, we decompose the wage inequality using workers' skills and market structure as subgroups in order to determine the contribution of the subgroups to the overall wage inequality in the U.S. and Turkish manufacturing sectors. The analysis is done using annual data from 1981 to 2005.

The results show that in terms of workers' skills, where non-production workers represent skilled labor and production workers represent unskilled labor, wages of production workers contributed more to the total wage inequality than did wages of non-production workers (except in 1992 for Turkey) for both the U.S. and Turkey, but the magnitude of the difference is much larger for the U.S. than for Turkey.

Moreover, for Turkey, within-group inequality is more important in explaining the overall wage inequality than between-group inequality. This is true considering the market structure of the Turkish manufacturing sector as a subgroup and without it; whereas it is different for the U.S. For the U.S., when we consider the market structure of the manufacturing sector as a subgroup, within-group inequality explains almost all the wage-inequality, while the between-group wage inequality contributes very little to the overall wage inequality. On the other hand, without considering the market structure of the U.S. manufacturing sector as a subgroup, both within-group and between-group inequalities have almost equal importance in explaining overall wage inequality.

In terms of market structure, within-group inequality explains the majority of the overall wage inequality for both the U.S. and Turkish manufacturing sectors. In addition, in the U.S., the competitive industries contribute more to the overall wage inequality than do the tight oligopoly industries. The opposite holds for Turkey: Tight oligopoly industries contribute more to the overall wage inequality than do competitive industries. This can be explained, in part, by the size of each industry in each country.

II. Main Differences between the U.S. and Turkish Manufacturing Industries

In this section, we compare the U.S. and Turkish manufacturing industries in the context of their main structure; wage inequality, market structure, and productivity. Table 1 compares the U.S. and Turkish manufacturing industries using

main descriptive statistics, such as number of companies, number of workers, value added and capital expenditure. We see that the chemical industry is the most productive industry in the U.S. manufacturing sector. This industry produces more than 15% of all the manufacturing sector's value added, and controls about 15% of all capital expenditure in the manufacturing sector. The second most productive industry is the transportation equipment industry, which contributes 10% of the value added to the manufacturing sector, but its capital expenditure is not very high. Other industries with a high value added include the food manufacturing and computer and electronic product manufacturing industries. The electronic product manufacturing and petroleum and coal product manufacturing industries are critical industries in terms of capital expenditure for the U.S.

The Turkish manufacturing industry is specialized in textile, transportation equipment, and food manufacturing. These three industries produce about 30% of all the manufacturing sector's value added. Capital expenditures are high in the petroleum and coal product, textile, and transportation equipment industries. From Table 1, we see that while the U.S. specializes in capital-intensive and highly productive industries, Turkey specializes in labor-intensive and low productive industries. These differences are common between developed and developing countries.

Another difference between the two countries' manufacturing sector structures is in terms of the number of companies. In the U.S., fabricated metal product manufacturing is the most competitive with the largest number of companies and uses the largest number of workers, whereas leather and allied product manufacturing and petroleum and coal product manufacturing are the most concentrated with the smallest number of companies and the smallest number of workers. One difference between these two industries, though, is that petroleum and coal product manufacturing uses more capital and has higher value added than leather and allied product manufacturing.

In Turkey, textile mills and apparel manufacturing is the most competitive with the largest number of companies by far and the largest number of workers. This industry also has the highest value added and the second highest capital expenditure. The least competitive industries are beverage and tobacco product manufacturing and petroleum and coal product manufacturing. These industries have the smallest number of companies and the smallest number of workers.

Table 1. Percentage Shares of Sub-Industries for all the Manufacture Sector Industries

United States 2007*		Company Numbers	Worker Numbers	Value Added	Capital Expenditure
311	Food manufacturing	0.073	0.121	0.101	0.083
312	Beverage and tobacco product manufacturing	0.011	0.009	0.034	0.02
313	Textile mills and apparel manufacturing	0.059	0.04	0.018	0.011
316	Leather and allied product manufacturing	0.004	0.003	0.001	0.001
321	Wood product manufacturing	0.051	0.044	0.017	0.019
322	Paper manufacturing	0.011	0.034	0.034	0.042
323	Printing and related support activities	0.11	0.049	0.027	0.029

Table 1-Continued.

324	Petroleum and coal products manufacturing	0.004	0.007	0.053	0.114
325	Chemical manufacturing	0.034	0.05	0.153	0.148
326	Plastics and rubber products manufacturing	0.039	0.07	0.041	0.047
327	Nonmetallic mineral product manufacturing	0.039	0.039	0.03	0.049
331	Primary metal manufacturing	0.013	0.037	0.037	0.047
332	Fabricated metal product manufacturing	0.194	0.126	0.078	0.067
333	Machinery manufacturing	0.082	0.08	0.07	0.051
334	Computer and electronic product manufacturing	0.044	0.054	0.098	0.118
335	Electrical equipment, appliance, and component manufacturing	0.018	0.031	0.026	0.018
336	Transortation equipment manufacturing	0.037	0.119	0.122	0.098
337	Furniture and related product manufacturing	0.071	0.041	0.02	0.01
		1	1	1	1

Table 1-Conitnued.

	Turkey 2007**	Company	Worker	Value Added	Capital Expenditure
		Numbers	Numbers		
15	Food manufacturing	0.098	0.112	0.116	0.099
16	Beverage and tobacco product manufacturing	0	0.006	0.014	0.007
17	Textile mills and apparel manufacturing	0.236	0.293	0.165	0.124
19	Leather and allied product manufacturing	0.027	0.018	0.009	0.004
20	Wood product manufacturing	0.091	0.026	0.016	0.016
21	Paper manufacturing	0.007	0.016	0.02	0.03
22	Printing and related support activities	0.044	0.023	0.019	0.015
23	Petroleum and coal products manufacturing	0	0.002	0.025	0.169
24	Chemical manufacturing	0.012	0.03	0.064	0.051
25	Plastics and rubber products manufacturing	0.046	0.046	0.046	0.05
26	Nonmetallic mineral product manufacturing	0.04	0.065	0.094	0.101
27	Primary metal manufacturing	0.009	0.036	0.088	0.102

Table 1-Continued.

28	Fabricated metal product manufacturing	0.155	0.079	0.048	0.036
29	Machinery manufacturing	0.064	0.074	0.076	0.046
30	Computer and eectronic product manufacturing	0	0	0.001	0
31	Electrical equipment, appliance, and component manufacturing	0.025	0.044	0.054	0.031
34	Transportation equipment manufacturing	0.021	0.067	0.113	0.104
36	Furniture and related product manufacturing	0.124	0.063	0.033	0.017
		1	1	1	1

Source: * US Census of Bureau; Annual Survey of Manufactures, 2007; **TurkStat, Annual Industry and Service Statistics, 2007.

III. Wage Inequality in the U.S. and Turkish Manufacturing Industries

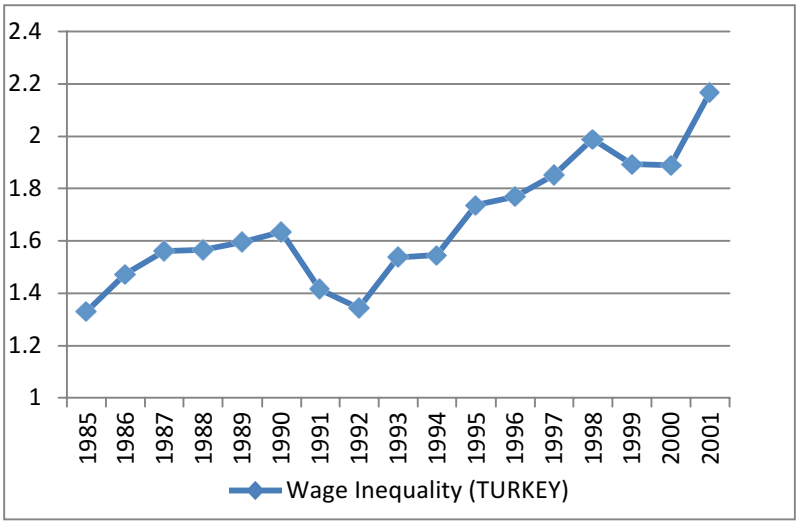
Another comparison, which is a crucial variable for this paper, is wage inequality. There are different ways to measure wage inequality. One of them is the wage ratio between non-production and production workers. By production workers, we refer to workers up to the line-supervisor level who are engaged in fabricating, processing, assembling, inspecting, receiving, storing, handling, packing, warehousing, shipping (but not

delivering), maintenance, repair, janitorial and guard services, product development, auxiliary production for the plant's own use (e.g., power plant), record keeping, and other services closely associated with these production operations at the establishment covered by the report. Employees above the working-supervisor level are excluded from this category.

Non-production employees refer to all other employees in the establishment, including those engaged in factory supervision above the line-supervisor level. This category includes sales (including driver salespersons), sales delivery (highway truck drivers and their helpers), advertising, credit, collection, installation and servicing of own products, clerical and routine office functions, executive, purchasing, financing, legal, personnel (including cafeteria, medical, etc.), professional, and technical employees. Also included in this category are employees on the payroll of the manufacturing establishment engaged in the construction of major additions or alterations utilized as a separate work force (U.S.). We assume that production workers, who are mostly blue-collar workers, are generally low-skilled labor; while non-production workers, who are mostly white-collar workers, are generally high-skilled labor. This distinction is common in the literature. Berman, Bound and Griliches (1994), Feenstra and Hanson (1996), Leamer (1998), Machin and Van Reenen (1998), Kizilirmak (2003), Meschi, Taymaz and Vivarelli (2011) use this method to measure wage inequality.

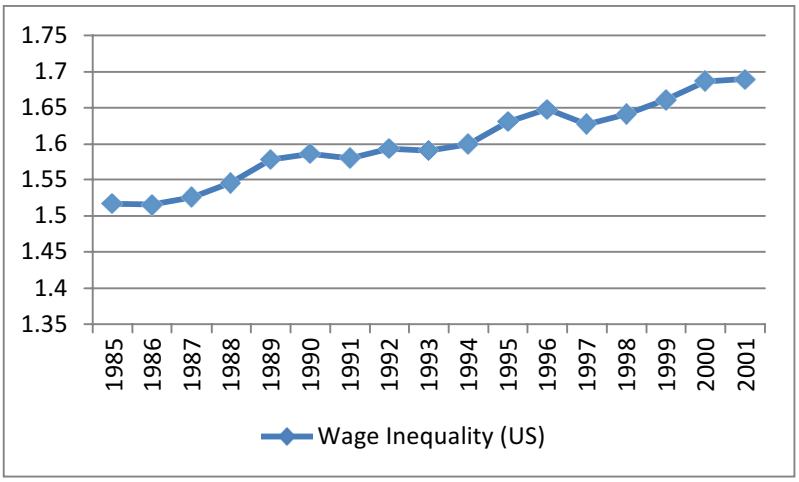
To compare the two countries' wage inequality, we use Figures 1 and 2, which show wage inequality for Turkey and the U.S., respectively, between 1985 and 2001. Wage inequality increased over this period of time for both the Turkish and U.S. manufacturing sectors. The rise in wage inequality for the Turkish manufacturing industry is larger than for the U.S. manufacturing sector. In Turkey, wage inequality increased from 1.33 in 1985 to 2.16 in 2001, which is a 62.4% increase; whereas in the U.S., wage inequality increased from 1.52 to 1.69, which is an 11.2% increase, over the same period.

Figure 1. Wage Inequality in Turkey: 1985-2001



Source: Annual industry statistics, Turkish Statistical Institute (TurkStat).

Figure 2. Wage Inequality in the U.S.: 1985-2001



Source: NBER-CES Manufacturing Industry Database.

Table 2 shows the occupational distribution of manufacturing employment for the U.S. and Turkey. The table shows production and non-production workers in detail. Table 2 reveals a few comments: First, the percentage of non-production workers in the U.S. is larger than in Turkey; whereas the percentage of production workers is smaller in the U.S. than in Turkey. Second, production workers' share decreased for the two countries, which is consistent with the information mentioned above. While the percentage of sales workers is decreasing, the percentage of clerical workers is increasing in the U.S. This might be related to Internet marketing. Customers can place their orders using computerized online applications. On the other hand, the main difference for Turkey is between craft and operative workers. The percentage of operative workers, which are more skilled labor than craft workers, increased over time, while the percentage of craft workers decreased.

IV. Market Structures of the U.S. and Turkish Manufacturing Sectors

The U.S. and Turkish manufacturing sectors have rather dissimilar characteristics with regard to market structure and technological changes. The U.S. economy is more competitive than the Turkish economy. Shepherd (1982) showed that the degree of competition has risen slightly between 1939, 1958, and 1980. Shepherd found that antitrust policies appear to be the main culprit behind the increased competition, even though import competition and deregulation have also been important. According to this study, the share of pure monopoly industries to national income decreased from 6.2% in 1939 to 2.5% in 1981. Shepherd also found that the shares of industries with dominant and tight oligopoly firms decreased, whereas the shares of competitive industries increased during the same period.[1]

[1] Shepherd classified the industries as: pure monopoly with market share at or near 100%, dominant firms with market share between 50% and 90%, tight

Table 2. Occupational Distribution of Manufacturing Employment

	United States		Turkey	
	1988*	2011**	2001***	2010****
Non-production Workers (White Collar)	37.2	39.3	20.3	23
Manager	10.9	9	5.4	6.3
Professional	8	11.1	2.9	2
Technician	3.3	6.2	7.1	7
Clerical worker	3.3	9.7	4.9	4.7
Sales Worker	11.7	3.3	NA	2.9
Production Workers (Blue Collar)	62.8	60.7	79.2	77
Craft	19	17.1	44.4	37.2
Operative	36.2	30.3	20.8	28.1
Laborer	5.7	NA	NA	NA
Service worker	1.6	NA	3.3	NA
Agricultural Labor	0.4	0.3	NA	0.09
Elementary occupations	NA	13	10.7	11.8

Source: *Annual Survey of Manufacturing and CPS, May 1973, Outgoing Rotations, 1979 and 1987. Eli Berman, John Bound, Zvi Griliches (1994); **BLS, 2010 Occupational Employment and Wage Estimates; *** Meschi, Taymaz, and Vivarelli, Labor Economics (2011); **** TurkStat, 2010 Household Labour Force Survey 2010.

oligopoly with four-firm concentration ratio above 60%, and effective competitive industries with four-firm concentration ratio below 40%.

Abdel-Raouf (2009) evaluated the market structure of the U.S. economy using a corrected four-firm concentration ratio[2]. She also found that the U.S. economy is fairly competitive. Abdel-Raouf found that 66.1% of the U.S. economy operates in competitive markets, 19.8% operates in loose oligopoly, 13.4% operates in tight oligopoly, and 0.8% operates in monopoly markets[3]. According to this study, the manufacturing sector is more competitive than other sectors. Specifically, 61% of the manufacturing industry operates in competitive markets, 24% operates in loose oligopoly, 14% operates in tight oligopoly, and 4% operates in monopoly markets.

Abdel-Raouf (2010) also analyzed the market structure of the U.S. manufacturing sector using 1997 and 2002 NAICS data. In this study, she incorporated the effect of international trade into the concentration ratio (CR_4) and found that trade-adjusted CR_4 is significantly lower than published CR_4. She also found that the effect of international trade on concentration is higher for the more concentrated industries than for the less concentrated ones. Based on the corrected CR_4 (average 1997-2002), electrical equipment and appliance, transportation equipment, fabricated metal product manufacturing, and the chemical industry have high concentration ratios.

The Turkish manufacturing industry has a rather noncompetitive market structure. The share of monopoly industries ($CR_4 > 95\%$) in total manufacturing is 9.4%; the share of dominant firm industries (CR_4 between 50% and 95%) is 40%; the share of tight oligopoly industries (CR_4 between 40% and 50%) is 15.3%; and the share of effective competitive industries

[2] Corrected CR_4 is calculated using the published CR_4 and correcting for international trade effects.

[3] In this study, competitive industries are defined as a market with $CR_4 < 40\%$, loose oligopoly as a market with CR_4 between 40% and 60%, tight oligopoly as a market with CR_4 between 60% and 95%, and monopoly as a market with $CR_4 > 95\%$.

(CR_4 < 40) is 35.3% [4] . In other words, 65% of the Turkish manufacturing industries are operating in noncompetitive market environments. Although there are eight industries in monopoly classification, these industries have important value added shares of all manufacturing industries (16%). The main highly concentrated industries include chemicals and chemical petroleum, coal, rubber and plastic production, and machinery and equipment, transportation equipment, and fabricated metal products. These industries are similar to the highly concentrated manufacturing industries in the U.S. The less concentrated industries are the food, beverages, tobacco, textile, clothing, wood, furniture and paper printing industries.

V. Decomposition Analysis and Results

In this section, we calculate the inter-industry wage inequality index for the U.S. and Turkish manufacturing industries and then decompose the wage inequality taking into account workers' skills and market structure as subgroups. In order to calculate wage inequality and the contributions of the subgroups to inequality, we use the Theil inequality index and entropy decomposition analysis.

To calculate the inter-industry wage inequality and decompose its sources, we use the Theil inequality index. Although the Gini index is more popular than the Theil index, it cannot be easily decomposed to show the sources of inequality. The Theil index has a minimum value of 0, implying perfect equality, with an unbounded upper value. The general formula is given by:

$$Theil = \frac{1}{N}\sum_{i=1}^{N} ln\left(\frac{\bar{y}}{y_i}\right). \quad (1)$$

Where: $\bar{y}$ is the mean income, y_i is income of group i, and N denotes the total number of observations.

[4] We calculate the average value of the years of 1985, 1990, 1995 and 2001 for the corrected CR_4 ratio. This data is from TurkStat Annual Manufacturing Surveys.

The Theil index can be decomposed into between group and within group components:

$$Theil = \sum \left(\frac{y^j}{y}\right) T_j + \sum \left(\frac{y}{y}\right) ln \left(\frac{y_j/y}{N_j/N}\right) \quad (2)$$

Where, N_j is the population in the subgroup (the number of industries or the number workers in group *j*), N is the total population (in this case, total number of industries or total number workers), y represents the total wages of the population, y_j is the wages of a subgroup (industries or workers), and T_j represents the Theil index for the *j*th group.

We classify workers into two groups: production and non-production workers. Non-production workers represent skilled labor and production workers represent unskilled labor. After we calculate the inter-industry wage inequality, we analyze the contribution of these two groups to the general wage inequality. We compile annual data on wages for each of the 81 four-digit manufacturing industries from 1985 to 2001 for Turkey. Data on wages for Turkey are available from TurkStat (Turkish Statistical Institute), *Annual Industry Statistics*. Annual industry wage data for the U.S. are obtained from the National Bureau of Economic Research (NBER), *NBER-CES Manufacturing Industry Database*. U.S. industry wage data cover 462 sub-industries from 1981 to 2005. We chose the period after 1981 for these two countries as an analysis period because the technological developements that caused the wage inequality between skilled and unskilled labor started to accelerate after the 1980s. We had to cut off the analysis at 2001 for Turkey and 2005 for the U.S. because of the availabiliy of the data[5]. We use per capita industry wages when calculating wage inequality

[5] Turkstat has collected industry wages data in the context of NACE codes since 2002 which is different from earlier period that was ISIC codes. In addition to classification problem, the methodology which is used for industry variable has changed at this time period.

between industries, and non-production and production workers and their contributions to total wage inequality.

Next, we analyze the contribution of the sub-industries to the total wage inequality based on their competitive level. To judge the level of competition in each industry, we use an adjusted four-firm concentration ratio, (CR_{4T}) [6], which incorporates international trade into the published CR_4 to accurately measure the competition level in the market. While it is possible to obtain annual CR_{4T} data for four-digit Turkish manufacturing industries from TurkStat, it is not available for the U.S. For the U.S. manufacturing industries, six-digit CR_4 (and CR_{4T}) data are available in 5-year increments. Another problem with the U.S. CR_{4T} data is that there are two different industry classification systems, the SIC and the NAICS (the SIC system was used until 1997 and the NAICS system has been used since then). To overcome this problem, we use Abdel-Raouf (2010) CR_{4T} data. Abdel-Raouf (2010) calculated the trade-adjusted concentration ratios (CR_{4T}) for the U.S. manufacturing industries using 1997 and 2002 NAICS data. We assume that the mean value of the 1997 and 2002 concentration ratio is constant during the period of 1985 to 2005. This is not an unreasonable assumption because market structure is not a highly volatile variable.

We classify the manufacturing industries into four groups usings their CR_{4T} as follows: $CR_{4T} \leq 20$ for low concentrated industries (fairly competitive); $20 < CR_{4T} \leq 40$ middle concentrade industries (competitive); $40 < CR_{4T} \leq 60$ highly concentrated industries (loose oligopoly); $CR_{4T} > 60$ very high concentrated industries. There are numerous studies which use such a classification in the industrial organization literature; for

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[6] The adjusted concentration ratio for international trade $CR_{4T} = (\frac{S_4 - CR_4 xX}{S+M-X}) * 100$ where S_4 is value of shipment for the four largest firms in the industry, S is total value of shipments in the industry, X is the value of exports and M is the value of imports.

example, Shepherd (1982), Domowitz et al. (1987), Ghosal and Loungani (1996), and Abdel-Raouf (2010).

Using the manufacturing industry wages, we calculate the Theil inequality index and use it to explain the inter-industry total wage inequality for the U.S. and Turkish manufacturing industries[7]. The results, which are presented in Figure 3, show that wage inequality between sub-industries for Turkey sharply increased during the research period; while for the U.S. it has been volatile. The most important wage inequality increase in the Turkish manufacturing industries started after 1987. Wage inequality between industries in Turkey increased by 130% between 1987 and 1991. During this period, Turkey accelerated its liberal economic reform, which started in the early 1980s. After the 1994 economic crisis in Turkey, wage inequality decreased slightly, but it began to climb again after 1997. Wage inequality in the U.S. rose from 0.036 in 1993 to 0.040 in 1995. After 1996, wage inequality declined acutely until 1999. It remained almost constant until 2001, dropped in 2002, and then rose again after that. The decrease in the wage inequality was also noted by Galbraith and Cantu (2001). They calculated wage inequality for the U.S. manufacturing industry using the Theil index for the period of 1920 to 1995. The main root for the U.S. wage inequality was the 1970s and 1980s period.

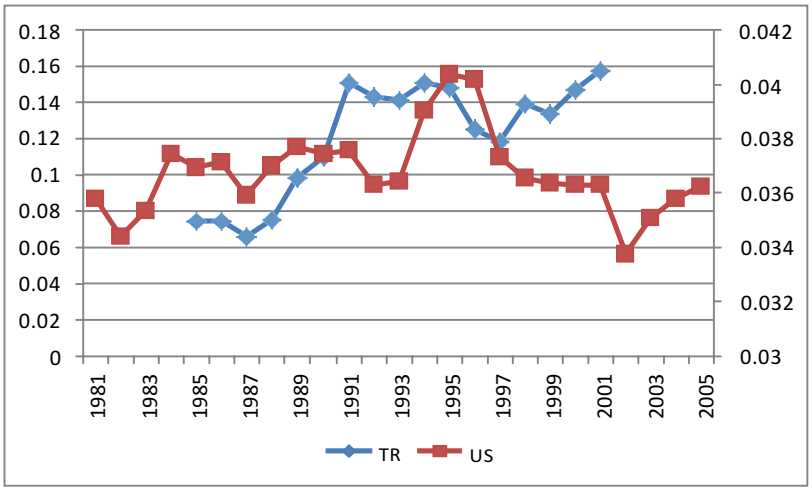
Card and DiNardo (2002) divided the U.S. wage inequality into three time periods. During the late 1960s and 1970s, wage inequality was relatively constant. The 1980s was a period of increasing wage inequality, with most of the increase occurring early in the decade. Finally, wage inequality appears to have stabilized in the late 1980s. They explained rising wage inequality in the early 1980s to labor market institutions. According to them, the main culprit is the decline in the real

[7] We use DAD (Distributive Analysis/Analyze Distributive) software to calculate inequality index and decomposition analysis. DAD which was first developed by Araar and Duclos, covers most regular computation and graphing of inequality, poverty, and social welfare discussed in the literature.

value of the minimum wage. Declining unionization and reallocation of labor caused by the 1982 recession can explain much of the rise in the overall wage inequality in the early 1980s.

Autor et al. (2006) analyzed the overall wage inequality for the 1963-2005 period using the Current Population Survey and showed that wage inequality increased in the 1980s and then plateaued in the 1990s. This is consistent with the findings of Card and DiNardo (2002).

Figure 3. Theil Index of Total Inter-Industry Wage Inequality



Total wage inequality, as measured by the Theil index, between non-production and production workers for Turkey increased incrementally during the research period, Figure 4. This result is similar to what is seen in Figure 1, which shows the ratio of non-production and production workers' wages. Total wage inequality between these two groups was 0.08 in 1985 and 1.18 in 2001. The inequality began to rise dramatically after 1987. Figure 4 shows another important result: within-group inequality is larger than between-group inequality. We conclude that, in explaining the overall wage inequality, the

inequality within these two groups is more important than the inequality between non-production and production workers' wages.

Kim and Sakamoto (2008) analyzed the increasing wage inequality trend in the U.S. between 1983 and 2002. They found that between-occupational variance declined, while the within-occupational variance increased; this result is inconsistent with the common sociological view. Decomposition calculations indicate that 70.3% of the increase in the Theil index of wage inequality between 1983–1985 and 2000–2002 occurred within occupations.

Mouwa and Kalleberga (2010) found that between-occupation changes explain 66% of the increase in wage inequality from 1992 to 2008 for the U.S. occupational differences in wages and became more prominent in explaining wage differences during the past 15 years. Between-occupation changes explain 66% of the increase in inequality from 1992-1994 to 2007-2008, and the explanatory power of occupations has risen from 0.382 in 1983 to 0.433 in 2008.

Williams (2013) decomposed trends in British wage inequality into between-occupation and within-occupation components and showed that, although most wage inequality is within occupations, it is the inequality between occupations that accounts for the major part of growing wage inequality.

Figure 5, which shows the relative contribution of the subgroups to the total wage inequality in Turkey, indicates that the wages of production workers consistently contributed more to total wage inequality than did the wages of non-production workers (except in 1992).

Wage inequality between production and non-production workers for the U.S. rose during the period of 1981 to 2005, Figure 6. The increase in wage inequality in the U.S. is smaller than in Turkey. The most notable increase in the wage inequality for the U.S. occurred during the 1993 to 1996 period, during

Figure 4. Total Wage Inequality between Non-production and Production Workers in Turkey

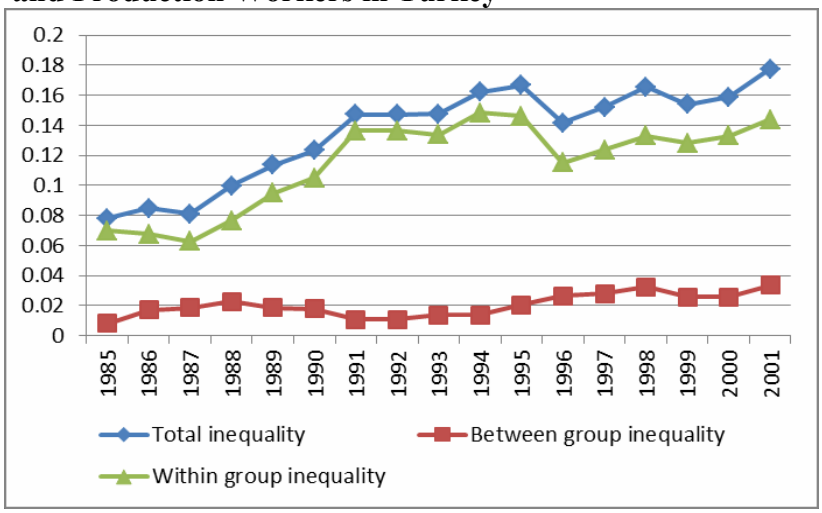
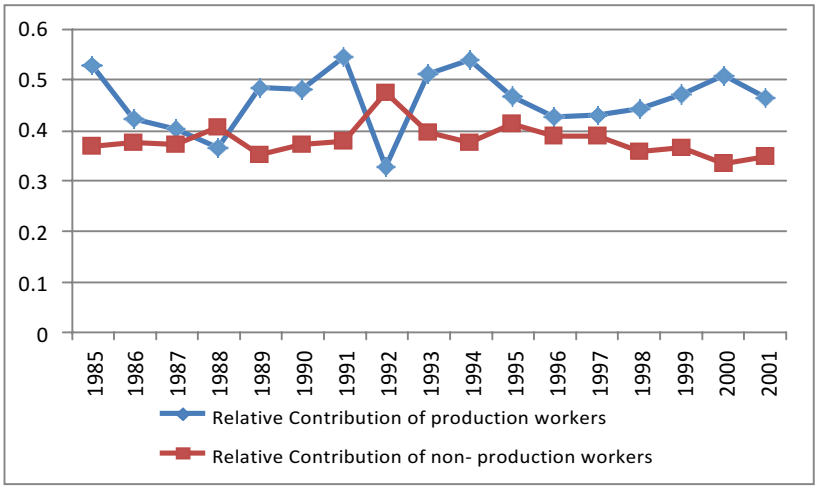


Figure 5. The Relative Contributions of the Subgroups to Total Wage Inequality in Turkey



Note: The analysis is in terms of production/non-production workers' wages.

which technological improvements and globalization increased most notably. Wage inequality climbed 14 percentage points in this 3-year period. This result is consistent with what is shown in Figure 3. Although within-group inequality was more important than between-group inequality in explaining the overall wage inequality until the early 1990s, the latter increased after 1997. This finding differs from Turkey's result, which shows that within-group inequality is always higher than between-group inequality.

Figure 6. Total Wage Inequality between Non-production and Production Workers in the U.S.

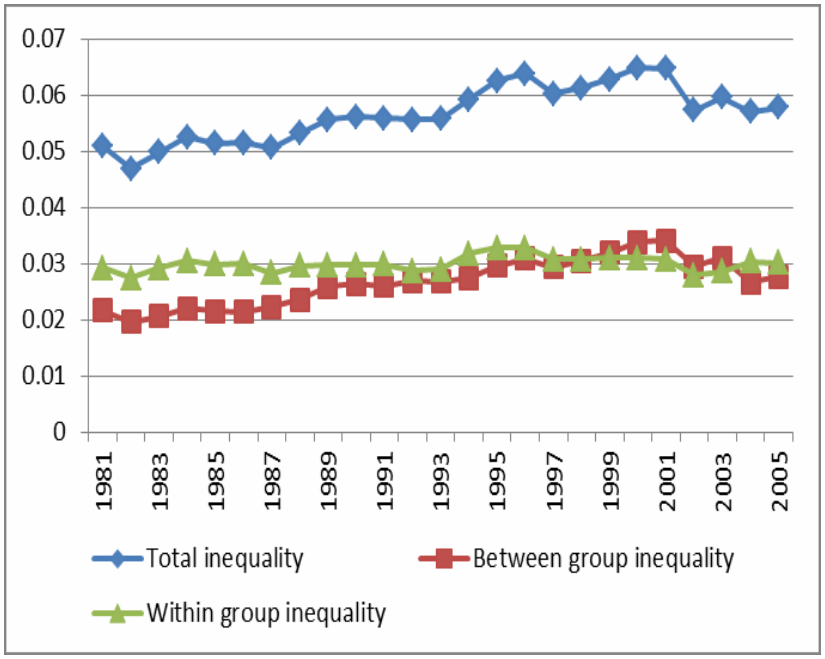
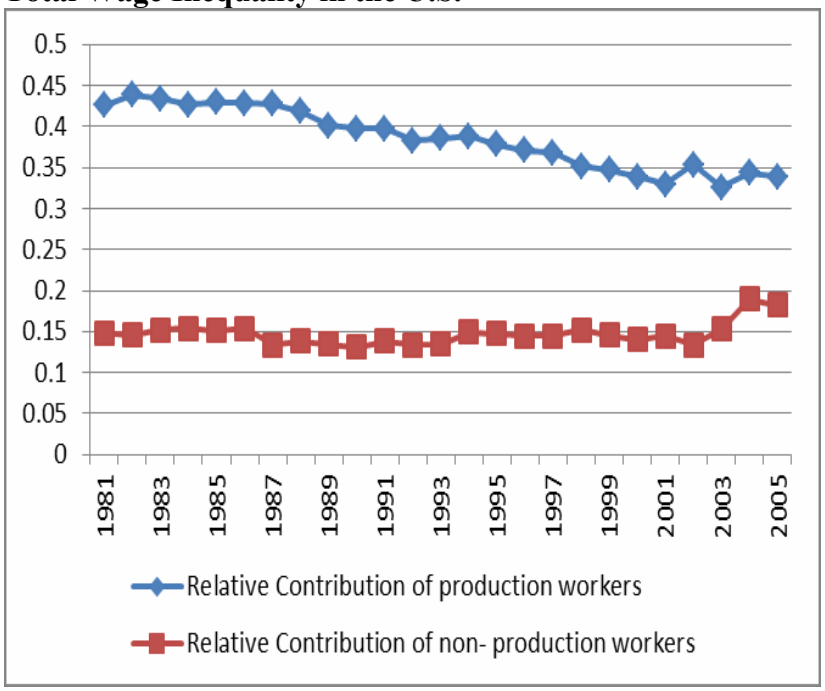


Figure 7 shows the relative contributions of the production and non-production subgroups to total wage inequality in the U.S. Even though production workers' wages contributed more to total wage inequality than non-production workers' wages, this effect gradually decreased during the research period. Recently,

the contribution of the wages of non-production workers to the total wage inequality has increased. Furthermore, the difference between the relative contribution of production and non-production workers to the total wage inequality is much more noticeable in the U.S. than in Turkey.

Figure 7. The Relative Contributions of the Subgroups to Total Wage Inequality in the U.S.



Note: The analysis is in terms of production/non-production workers' wages.

Figures 8 to 11 show the inter-industry wage inequality using market structure as a subgroup. When using the market structure as a subgroup, the wage inequality in Turkey is higher than in the U.S. In addition, wage inequality represents an increasing trend for Turkey, Figure 8, blue line; while it is more stable for the U.S., Figure 10, blue line. In contrast, within-group inequality contributed more than between-group inequality to

the total wage inequality in both countries. An important and interesting result from Figures 9 and 11 is the difference in the relative contribution of market structure to the wage inequality in each country. While fairly competitive industries have the highest contribution to total wage inequality in the U.S. manufacturing industries, they have the smallest contribution to total wage inequality in Turkey. In contrast, tight oligopoly has the highest contribution to the total wage inequality in Turkey's manufacturing industries and the lowest contribution to the total wage inequality in the U.S.

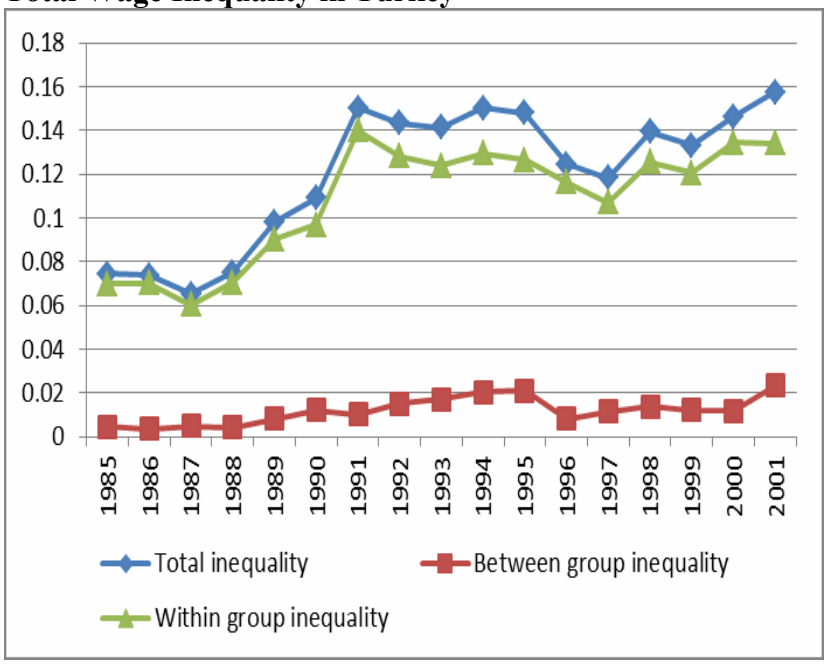
There are two different approaches to explain the relationship between market structure and wage inequality. In one approach, there is a positive relationship between the level of competition and wage inequality (Boone, 2000; Vives, 2004 and Guadalupe, 2007). This approach considers cost of production and union power. According to this approach, firms that operate in a highly competitive structure need a low cost of production. Therefore, firms should choose skilled labor in order to decrease costs. This competition between firms causes wage inequality because there is more demand for skilled labor than unskilled labor. The result of increased competition between firms is weak union power and an increase in wage inequality.

In the other approach, weak competition leads to increased wage inequality. Per this approach, there is a negative relationship between the level of competition and wage inequality. This analysis relates market structure to technological development. As mentioned earlier, the highly concentrated industries, having low competition, have more advanced technology. Because technological developments occur in highly concentrated industries, demand for skilled labor may be higher than in less concentrated industries. This relationship may inversely affect the wage inequality-market structure relationship. Hence, wage inequality might be higher in industries with low competition.

We can explain the results shown in Figures 9 and 11 by considering these two approaches and with some assessments.

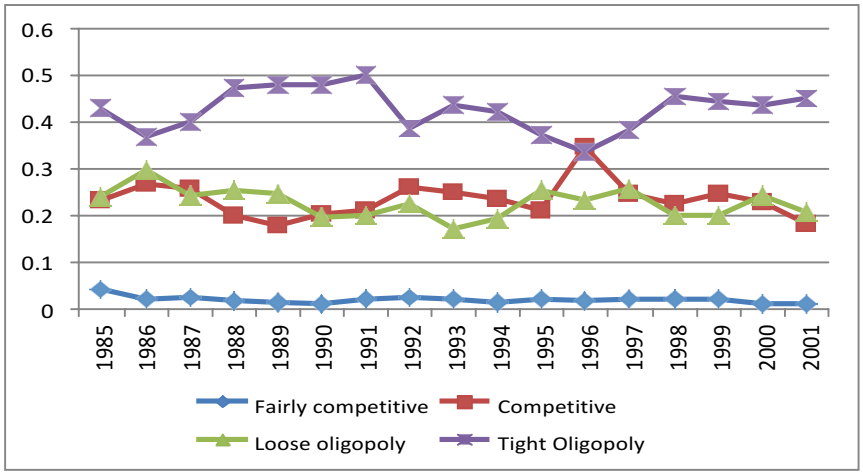
Although there is a negative relationship between technological improvements and competition level in the U.S. and Turkish manufacturing industries, this relationship is stronger for Turkey. Consequently, on the one hand, the less-competitive industries, loose and tight oligopoly industries, with higher wage inequality and better technology contributed more to the wage inequality than did the highly competitive industries in Turkey. On the other hand, the highly competitive industries, fairly competitive and competitive industries, which are more cost effective, and have less unionization rates and higher wage inequality, contributed more to wage inequality than did oligopoly industries in the U.S.

Figure 8. The Relative Contributions of the Subgroups to Total Wage Inequality in Turkey



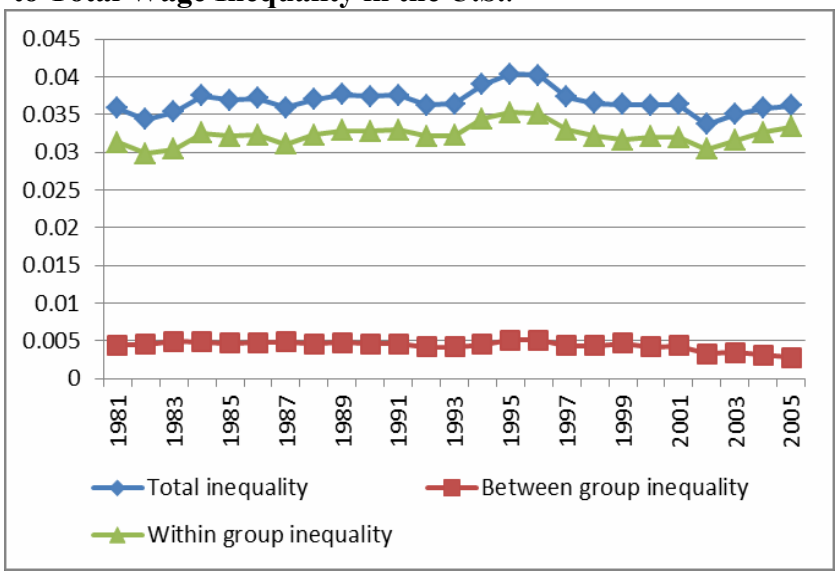
Note: The analyis is in terms of market structure.

Figure 9. The Contribution of the Sub-industries to Total Inequality in Turkey



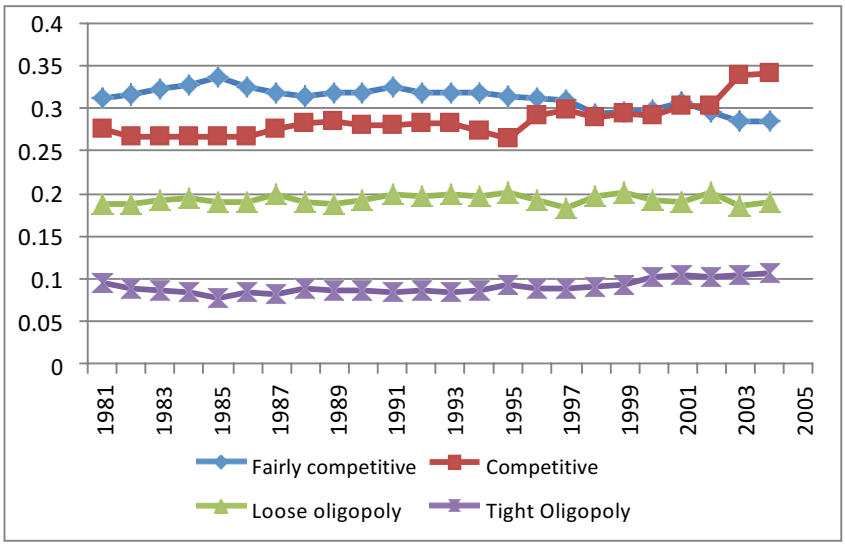
Note: The analyis is in terms of market structure.

Figure 10. The Relative Contributions of the Subgroups to Total Wage Inequality in the U.S..



Note: The analyis is in terms of market structure.

Figure 11. The Contribution of the Sub-industries to Total Inequality in the U.S.



Note: The analyis is in terms of market structure.

VI. Conclusion

Wage inequality increased between 1985 and 2001 for both the U.S. and Turkish manufacturing sectors. The rise in wage inequality for the Turkish manufacturing industry is larger than for the U.S. manufacturing sector. In Turkey, wage inequality increased by 62.4%, whereas in the U.S., wage inequality increased by 11.2% over the same period. There are different factors that explain the increase in wage inequality in each country. In this study, we analyzed the effect of market structure in explaining the wage inequality in both the U.S. and Turkish manufacturing sectors.

Using data from the NBER and TurkStat from 1981 to 2005, we calculated the Theil inter-industry wage inequality index for the U.S. and Turkish manufacturing sectors and decomposed it using workers' skills and market structure as subgroups in order

to determine the contribution of each subgroup to the overall wage inequality.

We found that when using workers' skills as a subgroup, wages of production workers contributed more to total wage inequality than did wages of non-production workers (except in 1992 for Turkey) for both the U.S. and Turkey but the magnitude of the difference is much larger for the U.S. than for Turkey.

Moreover, for Turkey, within-group inequality is more important in explaining the overall wage inequality than between-group inequality. This is true when using the market structure of the Turkish manufacturing sector as a subgroup and without it; whereas for the U.S., it is different. For the U.S., when we consider the market structure of the manufacturing sector as a subgroup, within-group inequality explains almost all the wage-inequality, and the between-group wage inequality contributes very little to overall wage inequality. On the other hand, without considering the market structure of the U.S. manufacturing sector as a subgroup, both within-group and between-group inequalities have almost equal importance in explaining the overall wage inequality.

In terms of market structure, the within-group inequality explains most of the overall wage inequality for both the U.S. and Turkish manufacturing sectors. In addition, in the U.S., the competitive industries contributed more to the overall wage inequality than did tight oligopoly industries; whereas in Turkey it is the opposite: Tight oligopoly industries contributed more to the overall wage inequality than did competitive industries. That can be explained, in part, by the size of each industry in each country. In the U.S., about 66% of the manufacturing sector industries operate in a competitive market structure, whereas in Turkey, 65% of the Turkish manufacturing sector industries operate in a non-competitive market structure.

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