Explaining the Decreasing Wage Inequality Puzzle in Turkey

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Paper Prepared for the IARIW 33rd General Conference

Rotterdam, the Netherlands, August 24-30, 2014

Second Poster Session

Time: Thursday, August 28, Late Afternoon

EXPLAINING THE DECREASING WAGE INEQUALITY PUZZLE IN TURKEY

Educational Attainment and Wage Inequality in Turkey

(Preliminary version)

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Abstract

This paper investigates the observed decrease in wage inequality in Turkey over the last decade, by looking at the relationship between the distribution of wages and the educational attainment of the workforce. The main hypothesis of the paper is that expanding the supply of educated labour, where there is stagnant demand for it, causes the rates of return to education to fall rapidly which then puts a downward pressure on wage inequality. Considering the differences in dynamics of labour force participation and wage determination, analyses are performed separately for men and women. After accounting for the bias in selection to wage employment, the key findings of our paper suggest that decreasing wage inequality was mainly due to decreasing returns to human capital, and decreasing residual wage dispersion. It is also found that the decrease in residual wage dispersion was mainly due to the decreasing price of unmeasured human capital. The effect of changes in the composition of human capital is found to be small.

Key words: wage inequality, selection bias, labour supply, decomposition

JEL classification code: J31, J82, I24

1. Introduction

The last four decades have seen an increase in wage inequality across several countries, amongst both western industrialised nations and developing nations.[1] Studies analysing this increase in wage inequality have mostly explained it using the supply-demand approach and attributed the rising inequality to an increase in the relative demand for skilled workers.[2] An increase in education premiums, resulting from this imbalance between demand and supply of skills, in particular a steep increase in the wage gap between college and high school graduates, has been documented for several OECD countries (Bound and Johnson, 1992; Katz and Murphy, 1992; Berman et al., 1997; Machin and Reenen 1998; Atkinson, 2003).

In contrast to these trends, Turkey over the last decade has seen a decrease in wage inequality; this finding is robust regardless of the inequality measure used. The period of declining wage inequality in Turkey has coincided with a rapid expansion of education in the country, potentially increasing the supply of skilled workers. While a number of studies explaining the rise in inequality have looked at the link between wage inequality and demand for skills, studies analysing the supply of skills and its impact on wage inequality are limited.[3] In this paper we look at the relationship between the wage distribution and the educational attainment of the workforce to explain the observed decrease in inequality in Turkey. The main hypothesis of this paper is that expanding the supply of educated labour, where there is stagnant demand for it, causes the rate of return to education to fall rapidly and decreases wage inequality.[4]

[1] Jenkins (2007) provides a good summary of findings and relevant literature for the industrialised countries.
[2] There are some papers which show that institutional factors such as, unionization, minimum wages and collective bargaining practice have also had substantial effects on wage distribution (Fairris et al., 2008; Card et al., 2003; Lee 1999).
[3] See Naticchioni et al., (2008) for an analysis of Italian labour market, and Popli (2011) for an analysis of the Mexican labour market.
[4] A fall in inequality has also been observed over the 2000s in several Latin American countries; this decline has been attributed in part to a fall in skill premiums (Lustig et al., 2013)

To understand the factors affecting wage inequality in Turkey over this period, the change in wage distribution between 2002 and 2010 is decomposed into three components: the effect of returns to human capital (price of human capital), the effect of changes in the composition of human capital (changes in covariates), and changes in residual distribution (price and composition of unmeasured human capital characteristics). The decomposition method used in this analysis is the one proposed by Lemieux (2002), which is a unified form of two most popular decomposition techniques in the literature which were proposed by Juhn et al. (1993) and DiNardo et al. (1996).

This paper makes several key contributions to the literature. As far as we know, this is the first comprehensive study documenting and explaining the decline in wage inequality in Turkey for *both* men and women. Much of the literature on Turkey has focused on either looking at wage inequality for men, or looking at specific sectors of the economy. The main reason given for not looking at women is their low labour force participation rates. In this paper we take into account that there is a selection bias, i.e. employment in the wage sector cannot be assumed to be random (particularly for women); we incorporate selection bias within the Lemieux (2002) decomposition method, which then allows us to look at the distribution of wages for women as well. Further, instead of focussing on specific sectors of the economy, we look at *all* wage earners. We also use more recent 2010 data; other studies only cover the period up to 2002.

The key findings of our paper suggest that decreasing wage inequality was mainly due to decreasing returns to human capital (decreasing skill premiums) and decreasing residual wage dispersion. Depending on the inequality measure used, these two factors explain almost all of the change in the wage distribution for both men and women. While, for men, the fall in inequality in the tails of the wage distribution is largely explained by the decrease in coefficients (i.e. returns to the measured human capital characteristics), for women, the

decrease in inequality in the upper tail is explained more by the decrease in returns to the unmeasured characteristics. It is also found that, for both men and women, the decrease in residual wage dispersion was mainly due to the decrease in the price of unmeasured human capital. Finally, the effect of changes in the composition of human capital is found to be very small.

The rest of the paper is structured as follows: Section 2 provides some background information on the macroeconomy, changes in the supply of skilled labour, and the distribution of wages in Turkey. Section 3 outlines the estimation method and section 4 describes the data used in this paper. Section 5 presents the wage regression estimations and decomposition results. Section 6 summarizes and concludes.

2. Background literature

Macroeconomic environment

Turkey experienced several major economic crises starting from the 1990s. The first crisis occurred with the Gulf War in 1991. The second crisis, which was triggered by fiscal and external imbalances, occurred in 1994, when the country witnessed a negative growth rate of 6.1 per cent. After a short period of recovery, due to the adverse effects of the Asian, Russian and Brazilian crises, the Turkish economy experienced another slowdown in 1998 and 1999. The biggest crisis of Turkey's recent history, mainly due to major capital outflows, occurred in November 2000 and February 2001, which led the GDP declining by 7.5 per cent in 2001 in real terms (Alper, 2001).

In terms of growth rates, the post-2001 period can be defined as the recovery period. The real growth rate was 7.9 per cent in 2002 and the economy grew by 6 per cent on average until 2007 when the recent global economic crises first showed its effects on Turkey. However, in contrast to the fast growth performance across sectors, additional employment

was not generated. The rate of unemployment was 6.5% in 2000 and it increased to 10.3% in 2002. The unemployment rate remained high and never fell below 10 per cent despite the rapid surges in GDP and exports. The period covered in this study (post 2002) has been defined as the period of *jobless-growth* for the country. For further details on the Turkish macroeconomic conditions see Yeldan (2006; 2011) and Telli et al. (2007).

Changing supply of skilled labour force

Since the 1990s there has been a rapid increase in the number of universities in the country. In 1991, there were only 29 universities in Turkey. In 1992, 24 new universities were established in one year. With the "a university in each city" policy and growing private sector participation, the number of universities reached 165 by 2011. As a consequence of these new universities, the number of university students also increased substantially; for instance, from 1994 to 2011, the number of students in formal university education, by a more than 300 per cent increase, rose from 1.2 million to 3.7 million (Turkey National Statistics Institute; TurkStat henceforth).

There are well documented differences in the quality of teaching in basic education in Turkey (World Bank, 2011; Owings et al., 2012). These quality differences have persisted in higher education as well. The fast increase in the number of universities in Turkey has been accompanied by a rising difference between old and new universities in terms of equipment, funding, and resources which can be expected to lead to differences in the quality of education. Hatakenaka (2006) argued that those new universities which are not located in metropolitan centres find it difficult to recruit qualified people who are unwilling to relocate to these regions, even though several measures have been tried to address these issues.[5] In addition, due to the central university entrance examination system, better students have the

[5] For instance, there used to be a requirement for academics to 'serve' in outer areas before being promoted. Today, there is a salary supplement to provide incentives for people to work in these universities.

chance of studying in the universities with better resources and this leads to further skill differences between university graduates.

The second important development that happened over the last two decades was the increase in the years of compulsory education. Before 1997, the Turkish education system was organized as five years of compulsory primary school, three years of middle (or secondary) school, three years of high school and vocational high school and university education which requires two to six years of study depending on the programs. The educational reform that came in to effect in 1997 increased compulsory education to eight years (five years of primary schooling and three years of middle school).

Considering these two developments, it can be argued that the supply of educated labour continuously increased starting from early the 1990's. According to the TurkStat web database, in 1988 the share of women (men) with university education in the labour force was 4% (5%). By 2002, this share had increased to 12% for women and 9% for men. By 2010 the corresponding numbers for women and men were 21% and 14%, respectively. Over the same period, the share of individuals with education less than high school in the labour force decreased for both men and women. Based on these observations, a decrease in the educational premium can be expected; as the increasing supply of labour with higher education is likely to decrease the upward pressure on the wages of university graduates while decreasing share of workers with low level of education moderates the downward pressure on the wages of those workers. Further, based on increasing quality differences in education, there is likely to be greater variation in wages received by university educated workers.

Changes in the wage distribution

Studies of wage inequality in Turkey are limited and mainly focused on specific aspects of wage inequality such as wage dispersion between genders, sectors and regions. By using the quantile regression technique, Tansel and Bircan (2011) analysed the evolution of male wage inequality over the 1994-2002 period. Using the Household Budget Survey (HBS) they saw an overall decline in wage inequality in Turkey[6]; wage inequality declined in this period at the lower end of wage distribution while it increased at the top end. Their results showed that education contributed to higher wage inequality through both within and between dimensions; the within-groups inequality increased and between-groups inequality decreased. Therefore, they argued that the latter factor might have dominated the former contributing to the observed decline in male wage inequality over the 1994–2002 period.

Tansel (2005), using the 1994 Household Expenditure Survey, investigated wage gaps between public and private sector wages and genders. The results of her study indicated that for men, public sector wages were higher than private sector wages except at the university level, and state owned enterprise wages for men were higher than private sector wages. Also, while wages of men and women were at parity in the public administration, there was a large gender wage gap in the private sector in favour of men.

Elveren and Galbraith (2009) examined pay inequality in the Turkish manufacturing sector using the establishment level Annual Manufacturing Industry Statistics from 1980 to 2001. Using the between-group component of Theil's T statistic, they decomposed the evolution of inequality by geographic region, province, sub-sector and by East-West distinction for both private and public sectors. Their results showed that while inequality remained approximately the same between regions, it increased in the late 1980s in the

[6] Another study by Ozkoc, Gurler and Ucdogruk (2011) also finds a decrease in general income inequality between 2002 and 2006.

private sector between provinces, between East and West, as well as between manufacturing sub-sectors.

Kizilirmak (2003), using the Quarterly Manufacturing Industry Statistics, analysed increasing wage inequality in the manufacturing sector for the 1988-1998 period and argued that the change in relative demand for skilled workers was primarily due to within-industry skill upgrading.

In contrast to the above studies we use the most recent data from the Household Labour Force Survey (LFS), instead of the Household Budget Survey (HBS). The LFS has numerous advantages over the HBS: it has a much wider coverage and more observations which allows us to look at women, who are underrepresented in the labour market. All the national statistics are based on the LFS, and these are used for policy analysis; the main aim of this survey, unlike the HBS, is to look at the labour market[7].

3. Estimation Method

We start our analysis by looking at a Mincerian (Mincer, 1974) wage regression given as:

$$\boldsymbol{y_i = \beta X_i + \varepsilon_i} \qquad (1)$$

where y_i is log wages, X_i is the vector of individual characteristics that determine wages; β is the coefficient vector giving the marginal returns to the covariates in X_i; and ε_i is the random error term. The key individual characteristics that Mincer stressed were education (schooling) and experience (years in the labour market, including but not restricted to, on-the-job training). However, in subsequent empirical work vector X_i has included a wide range of wage-determining characteristics. Estimating the wage equation, as given by equation (1) is also often referred to as the human capital approach.

[7] The main aim of HBS is to collect consumption and expenditure information, though it has information on the labour market.

At an individual greater level of human capital (captured by an increase in education and/or the years spent in the labour market) leads to higher wages for the individual. However, an increase in educational attainment of the whole population (which constitutes an increase in supply of skilled workers) does not necessarily mean an increase in returns to education. In his seminal paper, Pritchett (2001) analysed the relationship between rising educational attainment of labour force and the growth rate of output per worker. Using cross-national data, he found a negative relationship between these two indicators on average. He argued that the marginal return to adding an additional year of schooling in the whole population can be substantially different from average returns estimated with a Mincerian regression at a single point of time depending on the shifts in skill demand. For instance, he asserted that marginal returns to education decrease as the supply of educated labour expands if the demand remains stagnant.

There are issues associated with changes in the demand side as well. Within the context of our analysis, if the demand for the skill increases, returns for the unmeasured human capital such as unobservable skills linked to school quality, intrinsic ability, and effort (which are the main reasons why workers with same level of education and experience have different wages) increase as well. In particular, the rate of increase in returns to unmeasured characteristics is greater for individuals who have higher education.[8] In econometric terms, residuals (ε_i) in Mincerian-type equations are empirically heteroskedastic. Therefore changes in skill premiums affect wage inequality in two ways simultaneously, first it affects the wage gap between workers with lower and higher education levels which causes an increase in the between-group inequality component. Second, it affects the wage dispersion within workers who have the same level of education but studied at schools with different qualities, which causes an increase in the within-group inequality component.

[8] Card and Krueger (1992) provided evidence that men who are educated at higher quality schools have a higher return to additional year of schooling and returns are also higher for individuals who studied with better educated teachers.

The hypothesis of this study is based on a combination of the demand and the supply arguments made above. This paper mainly argues that wage inequality decreases as a result of a rapid increase in the supply of educated labour if there is stagnant or slowly increasing demand for it, both of which happened in Turkey. Decreasing wage inequality is caused by two factors: first, the educational premium (as captured by β) decreases as the skill supply exceeds the limited demand; and second, returns to unmeasured human capital characteristics (embedded in ε_i), which are unobservable abilities of workers, decreases. To test this hypothesis, the evolution of wage inequality in Turkey between 2002 and 2010 is analysed. We decompose the wage inequality into different components: effect of returns to human capital (price of human capital); effect of changes in the composition of human capital (changes in covariates); and changes in residual distribution (price and composition of unmeasured human capital characteristics).

Decomposition Method

This study will make use of a decomposition method developed by Lemieux (2002), which unifies the residual imputation method given by Juhn, Murphy, and Pierce (1993) (JMP hereafter) and the re-weighting factor method given by by DiNardo, Fortin, and Lemieux (1996) (DFL hereafter). This method has several advantages compared to other decomposition methods. First, it allows for the decomposition of changes in the entire distribution of wage rather than only the decomposition of change in the mean wage. Second, it takes into account the distribution of residuals; unlike JMP it allows the distribution of covariates to influence the distribution of residuals, thus taking into account the problem of heteroskedasticity mentioned above. Finally, it is also possible to decompose the changes in residual distribution, which is an essential point for this study.

The first step of the method is to estimate separate Mincerian wage regressions for each year:

$$\boldsymbol{y_{it} = x_{it} b_t + u_{it}} \qquad (2)$$

where y_{it} is the real hourly wage of individual i at time t (here $t = 2002,\ 2010$); b_t is the vector of OLS estimators of coefficients for returns to human capital at times t; x_{it} is the vectors of covariates representing the human capital characteristics at times t; and u_{it} is the regression residual.

To compute the effect of changes in the prices of characteristics, following JMP, a counterfactual wage vector that would prevail in period t if the price of human capital were the same as they were in period s (where $t \neq s$) is constructed. To get the counterfactual wage vector, the coefficients from period t wage regression are replaced with coefficients from period s such as:

$$\boldsymbol{y_{it}^{a} = x_{it} b_s + u_{it}} \qquad (3)$$

Once the counterfactual wage y_{it}^{a} is constructed, it is straightforward to obtain the share of effect of changes in prices in the total change of wage distribution by comparing any inequality measure (such as Gini, Theil index, variance or wage gaps) for y_{it}^{a} and empirical distribution of wages for period s (y_{is}) and period t (y_{it}).

The second step of the method is to create the re-weighting factor which will be used to modify the original sample weights and calculate the effect of changes in covariates. The idea of modifying the sample weights, which are used to calculate sample statistics representative of the population, originally came from the cell-by-cell approach (in which covariates were grouped into a few mutually-exclusive categories) proposed by DFL. This method basically attaches a new counterfactual weight to each individual to keep the distribution of characteristics constant and thereby makes it possible to account for changes in covariates. DFL also suggest an alternative method to calculate re-weighting factor if the

cell-by-cell approach cannot be used (if there is a continuous variable or the numbers of groups are too many to do the computations). Their idea is to pool the samples of two periods and estimate a logit or probit model for the probability of being in the base year. Then the re-weighting factor is calculated by the propensity score which is the predicted probability that an individual in the pooled sample comes from the base year (P_{it}) conditional on covariates of the base year (x_{it}):

$$\boldsymbol{P_{it} = Prob(period = t | x_{it})} \qquad (4)$$

And the re-weighting factor is defined as

$$\boldsymbol{\Psi_i = \frac{P_{it}}{1 - P_{it}}} \qquad (5)$$

Finally new weights are computed by multiplying the original sample weights (w_{it}) with the re-weighting factor:

$$\boldsymbol{w^a{}_{it} = w_{it} \Psi_i} \qquad (6)$$

Following Lemieux's (2002) notation, the counterfactual values of wages that we will generate by using new weights are summarized in Table 1.

Table 1

	Variable	Weight	Resulting Distribution
(1)	y_{is}	w_{is}	Distribution in period s (for our analysis $s = 2002$)
(2)	y_{it}	w_{it}	Distribution in period t (for our analysis $t = 2010$; the base year)
(3)	y^a_{it}	w_{it}	Period t distribution with coefficients of period s (b_s)
(4)	y_{it}	$w^a{}_{it}$	Period t distribution with covariates of period s (x_{is})

The final stage of the decomposition is to calculate the effect of changes in the residuals on changes in the wage distribution between two periods. As mentioned earlier, Lemieux (2002) uses the residual imputation method which was originally proposed by JMP. With a strict human capital interpretation of wages, JMP argue that residual wage dispersion is mainly due to imperfect measurement of human capital in standard data sets. Accordingly, assuming a stable distribution of unmeasured skills over time, changes in residual wage inequality must be the result of a change in the returns to these unmeasured skills.

To understand the effect changes in unmeasured human capital prices have on the wage distribution, JMP propose a general setting in which a non-linear pricing scheme is applied to the residuals from the wage regressions:

$$\boldsymbol{u_{it} = p_t(\eta_{it}) + \epsilon_{it}} \qquad (7)$$

where η_{it} is unmeasured human capital; $p_t(.)$ a monotonic and continuous function, is a price function which gives the returns to unmeasured human capital; and ϵ_{it} is a random error term not linked with skills, which for simplicity is assumed to be zero.

The JMP model, as given in equation (7), provides flexibility by making it possible to generate any distribution of u_{it} from an arbitrary distribution of skills η_{it}. For instance, let $F_t(.)$ be the cumulative distribution function of u_{it}, such that $\eta_{it} = F_t(u_{it})$; substituting this in equation (7) gives us:

$$\boldsymbol{u_{it} = p_t(\eta_{it}) = F_t^{-1}(\eta_{it})} \qquad (8)$$

where η_{it} can be interpreted as the rank of observation *i* in the distribution of residuals while the non-linear skill pricing function $p_t(.)$ is the inverse cumulative distribution of u_{it}.

By using the skill pricing function, the counterfactual wages (equation (3)) can be rewritten as:

$$\boldsymbol{y_{it}^a = x_{it}b_s + u_{it} = x_{it}b_s + p_t(\eta_{it})} \qquad (9)$$

The decomposition is finalized by replacing the residuals in equation (9) with the residuals that would prevail if the skill pricing function was $p_s(.)$ instead of $p_t(.)$ such as:

$$\boldsymbol{y_{it}^b = x_{it} b_s + u_{it}^b = x_{it} b_s + p_s(\eta_{it})} \qquad (10)$$

where $u_{it}^b = p_s(\eta_{it}) = F_s^{-1} F_t(u_{it})$ is the counterfactual residual for observation *i*.

The obtained counterfactual wages now can be used to decompose changes in wage inequality. Extending JMP, counterfactual wages can also be combined with counterfactual weights to control for the distribution of covariates. In addition, having the counterfactual wage vectors, it is also possible to calculate any measure of inequality to see the effects of different factors on different parts of wage distribution.

The last but not the least, an important feature of the decomposition method is that it is also possible to decompose the changes in wage residuals. Since sample weights are used to calculate indices that represent the population, a comparison of the variances of residual wages using original sample weights and counterfactual weights provides information about how much of the change in residual distribution is due to the change in covariates and the change in skill pricing function.

Selection Bias

According to TurkStat, nearly 30% of working men were self-employed in the year 2000. This share decreased to 23% in 2007. This considerable share of self-employed is an indicator of non-random participation in the wage sector. The selection bias problem becomes even more critical in wage estimations for women. Over the last 50 years, Turkey's female labour participation has been decreasing (Goksel, 2012). Moreover, according to the Global Gender Gap Report (2006), Turkey has the 6th lowest global gender gap index and the 5th lowest rank in economic participation and opportunity for women. As a result, Turkey, with 25%, has the 10th lowest female labour force participation rate among 130 countries

despite decreasing fertility rates and increasing schooling rates. Another problem that may cause selection bias is that there is a substantial share of unpaid family workers who traditionally work in the agricultural sector and are recorded as employed in employment statistics. According to TurkStat, for the year 2002, 49% of total female employment consisted of unpaid workers; as these women do not report any form of labour income they are automatically omitted from the sample of wage earners. Further the characteristics of these unpaid workers and the self-employed are very different from those who simply do not participate in the work force. Given the above issues we take into account the selection bias in our analysis.

In the first step, following Dubin and McFadden (1984), a multinomial logit model is estimated for sectoral participation. An individual *i* is categorized as having three options, these options are different for men and women. For men the three options are: (1) working in the wage sector, (2) being self-employed, and (3) being economically inactive (non-participant). For women the three options are: (1) working in the wage sector, (2) working as an unpaid family worker, and (3) being economically inactive (non-participant). The predicted probabilities from the multinomial logit model are then used to construct a selection correction term by using the formula provided by Hill (1983). In the second step of the model, augmented wage equations are estimated separately for men and women by including correction term into the covariates as an additional regressor. The augmented wage equation estimation results, then, are used in decomposition of the change in wage distributions of men and women between 2002 and 2010 as described in the section above.

4. Data and descriptive statistics

Data used in the analysis is from the Household Labour Force Survey (LFS) which is conducted by TurkStat; we use two waves: the 2002 and 2010 waves. The LFS has the largest sample of the Turkish labour force and contains information on both the workers' demographic characteristics and the characteristics of their main job for each individual within the household. Analyses are performed with 30,535 (56,728) male workers, and 7,979 (15,863) female workers for the years 2002 (2010), respectively.

For the analysis, two cross sections of full-time workers aged between 20 and 64 are used. The LFS contains information only on net monthly wages. In order to get hourly wages, monthly wages are first divided by 4.3 and then divided by hours of work per week reported by the interviewee. Finally, hourly wages are deflated by the consumer price index which is also provided by the TurkStat to obtain real hourly wages.

Following the work of Mincer (1974), human capital is represented by education and work experience (on-job-training). Educational qualifications of workers are grouped into six categories namely, no formal education, primary, secondary, high school, vocational high school and university. In 1997, compulsory primary education in Turkey was increased from 5 to 8 years and so the "middle school", which corresponds to a 3 year education between primary and high school level, was abolished. However, since there are still substantial number of workers with 5 years of primary education, an additional category "secondary education" is created to aggregate the middle school and 8 year primary education categories. Both of these education levels correspond to the same years of schooling (8 years) and theoretically these workers can be expected to have the same qualifications as the investment they make in human capital is equivalent. Work experience is obtained by the question of "year that you started your main occupation" so that the experience variable captures the years of experience in main their occupation rather than the latest job.

Table 2A presents the descriptive statistics of the variables for each sample year for women. Wage earning women are the most educated, with 39% of them having a university education in 2010. Unpaid family workers are the least educated, with a third of them having no formal education. Between 2002 and 2010 there has been a shift in the distribution of education for the wage earners, with a fall in the wage earners with primary (high school) education by 5% (4%) points, and an increase in the university educated women by 7% points. There has also been a fall in the labour market experience of women in the wage sector by about one year. Wage earning women on average have fewer children, are more likely to be heads of their household, and are more likely to come from households where other members of the household are also wage earners. Women in unpaid work tend to come from rural households where other members of the household are self-employed.

Table 2B presents the descriptive statistics of the variables for each sample year for men. Wage earning men are more educated relative to the other two groups (economically inactive and self-employed). There has been a shift in the distribution of education between 2002 and 2010, towards university educated workers in the wage sector. Similar to women, there has been a fall in the labour market experience of men in the wage sector by just over one year. There is not much difference in the number of children in the household between self-employed men and wage earning men; the economically inactive men on the other hand do come from households with fewer children. Self-employed men have a high proportion of other members of the household who do unpaid family work (possibly women in the family).

The mean wage for men is higher than the mean wage for women in 2002 and becomes almost equal in 2010. Mean wages for both men and women have increased over time; with a higher increase in mean wages of women. Variance in wages of women is twice as high as that for men; there has been a fall in variance of wages for both men and women over time.

Table 2A**:** Sample Averages for Women

	2002			2010		
	Economically inactive	U. family worker	Wage worker	Economically inactive	U. family worker	Wage worker
Mean log wages			5.32			5.62
			(0.01)			(0.01)
Education Dummies						
No formal education	0.21	0.33	0.04	0.25	0.32	0.06
Primary school	0.56	0.63	0.28	0.45	0.55	0.23
Secondary school	0.07	0.02	0.07	0.10	0.07	0.08
High school	0.09	0.02	0.17	0.10	0.03	0.13
Vocational high school	0.04	0.01	0.11	0.06	0.02	0.11
University	0.03	0.00	0.32	0.05	0.01	0.39
Experience	-	19.55	6.43	-	15.21	5.05
	-	(0.15)	(0.07)	-	(0.10)	(0.04)
Number of children						
Age ≤ 4 years	0.40	0.44	0.20	0.38	0.38	0.20
	(0.003)	(0.01)	(0.005)	(0.002)	(0.01)	(0.003)
5 ≤ Age < 11 years	0.60	0.72	0.37	0.52	0.61	0.33
	(0.004)	(0.01)	(0.01)	(0.003)	(0.01)	(0.005)
11 ≤ Age < 15 years	0.25	0.34	0.18	0.22	0.30	0.17
	(0.002)	(0.01)	(0.005)	(0.002)	(0.005)	(0.003)
Other members of the household						
Number of wage workers	0.59	0.14	0.82	0.67	0.25	0.79
	(0.003)	(0.005)	(0.01)	(0.002)	(0.005)	(0.01)
Number of self-employed	0.21	0.96	0.10	0.17	0.90	0.10
	(0.002)	(0.004)	(0.004)	(0.001)	(0.004)	(0.002)
Number of unpaid family workers	0.07	1.22	0.03	0.05	0.70	0.02
	(0.002)	(0.02)	(0.003)	(0.001)	(0.01)	(0.001)
Marital status dummy						
Never married	0.12	0.13	0.38	0.13	0.09	0.35
Married	0.82	0.85	0.56	0.80	0.89	0.57
Divorced	0.01	0.002	0.04	0.02	0.01	0.06
Widowed	0.05	0.01	0.02	0.05	0.01	0.02
Member of social security system	-	0.01	0.73	-	0.06	0.77
Head of household dummy	0.07	0.0003	0.10	0.09	0.005	0.10
Grandmother	0.06	0.14	0.06	0.06	0.15	0.05
Rural	0.29	0.92	0.18	0.23	0.86	0.13
Observations	130,037	9,934	10,720	110,663	15,185	20,255

Note: standard errors for continuous variables in parenthesis. Sample weights are used.

Table 2B: Sample Averages for Men

	2002			2010		
	Economically inactive	Self-employed	Wage worker	Economically inactive	Self-employed	Wage worker
MEAN LOG WAGES			5.38			5.61
			(0.004)			(0.002)
Education Dummies						
No formal education	0.06	0.10	0.02	0.10	0.09	0.03
Primary school	0.48	0.70	0.43	0.42	0.62	0.35
Secondary school	0.11	0.09	0.14	0.14	0.13	0.16
High school	0.18	0.06	0.14	0.16	0.07	0.12
Vocational high school	0.09	0.03	0.12	0.09	0.06	0.13
University	0.08	0.02	0.15	0.10	0.04	0.20
Experience		17.81	8.06		14.98	6.25
		(0.12)	(0.04)		(0.08)	(0.03)
Number of children						
Age $\leq$ 4 years	0.25	0.42	0.43	0.22	0.37	0.41
	(0.005)	(0.01)	(0.004)	(0.003)	(0.005)	(0.003)
5 $\leq$ Age < 11 years	0.38	0.71	0.60	0.34	0.60	0.54
	(0.006)	(0.01)	(0.005)	(0.004)	(0.01)	(0.003)
11 $\leq$ Age < 15 years	0.19	0.33	0.24	0.18	0.30	0.22
	(0.004)	(0.01)	(0.003)	(0.002)	(0.004)	(0.002)
Other members of the household						
Number of wage workers	0.39	0.15	0.37	0.46	0.22	0.42
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Number of self-employed	0.13	0.07	0.08	0.12	0.08	0.09
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)
Number of unpaid family workers	0.06	0.85	0.06	0.05	0.65	0.05
	(0.003)	(0.01)	(0.003)	(0.002)	(0.01)	(0.001)
Marital status dummy						
Never married	0.33	0.05	0.18	0.32	0.06	0.21
Married	0.65	0.93	0.82	0.66	0.92	0.78
Divorced	0.01	0.01	0.01	0.02	0.01	0.01
Widowed	0.01	0.01	0.002	0.01	0.01	0.002
Member of social security system		0.42	0.74		0.40	0.78
Head of household dummy	0.62	0.89	0.77	0.63	0.86	0.72
Rural	0.28	0.66	0.25	0.24	0.58	0.19
Observations	84,358	16,202	36,380	39,942	25,120	65,443

Note: standard errors for continuous variables in parenthesis. Sample weights are used.

5. Empirical Results

The first step in our empirical investigation is to look at the multinomial logit model for sectoral choice. Tables 3A and 3B show the relative risk ratios (RRR) from the maximum likelihood estimation of the multinomial logit model for women and men respectively. The base category of the model is the group of the economically inactive for both men and women. The RRR tells us how the probability of choosing wage employment or unpaid family work (self-employment in the case of men) relative to being economically inactive changes if we increase the indepedent variable by one unit. If the RRR is greater than 1, it means that the individual is more likely to be in wage employment or unpaid family work (self-employment for men) and accordingly, if it is lower that 1, the individual is more likely to be economically inactive.

Table 3A shows that for women, education at all levels increases the probability of choosing wage employment. Having other members of the household in the wage sector, being divorced, being head of the household, and having a grandmother in the household (this will capture help available to women, within the household, for childcare and other household responsibilities) also increases the probability of being in wage employment. The number of children in the household aged 5 or less, being married, and the number of self-employed members in the household all have a decreasing effect on wage employment.

Table 3B shows that for men, education at all levels, number of children in the household, other members of the household in the wage sector, and being head of the household increase the probability of choosing wage employment. Living in the rural area, and the number of unpaid family workers in the household all increase the likelihood of being self-employed.

Table 3A: Relative Risk Ratios (Women)

VARIABLES	2002 Unpaid family worker	2002 Wage worker	2010 Unpaid family worker	2010 Wage worker
Education;				
Primary School	0.98	2.26***	1.46***	2.17***
	(0.04)	(0.13)	(0.04)	(0.07)
Secondary school	0.54***	4.038***	0.97	3.19***
	(0.06)	(0.29)	(0.05)	(0.14)
High school	0.47***	6.02***	0.74***	4.65***
	(0.05)	(0.40)	(0.05)	(0.19)
Vocational high school	0.51***	10.04***	0.87	7.36***
	(0.09)	(0.71)	(0.07)	(0.32)
University	0.73	37.67***	0.68***	26.02***
	(0.15)	(2.53)	(0.07)	(1.04)
Number of children in the household;				
Age≤4	0.67***	0.70***	0.66***	0.67***
	(0.02)	(0.01)	(0.01)	(0.01)
5≤Age<11	0.95**	1.0	0.97*	0.99
	(0.02)	(0.01)	(0.01)	(0.01)
11≤Age<15	0.89***	1.07**	0.98	1.16***
	(0.03)	(0.03)	(0.02)	(0.02)
Other members of the household;				
Number of wage workers	0.71***	1.72***	0.80***	1.42***
	(0.02)	(0.03)	(0.01)	(0.01)
Number of self-employed	8.64***	0.85***	8.16***	0.90***
	(0.42)	(0.04)	(0.24)	(0.02)
Number of unpaid family workers	2.25***	0.73***	2.25***	0.69***
	(0.06)	(0.05)	(0.05)	(0.03)
Marital status;				
Married	2.03***	0.41***	2.94***	0.49***
	(0.14)	(0.01)	(0.15)	(0.01)
Divorced	0.61	1.13	0.86	1.42***
	(0.20)	(0.09)	(0.12)	(0.07)
Widowed	0.82	0.28***	1.24*	0.33***
	(0.14)	(0.02)	(0.16)	(0.02)
Head of household dummy	0.01***	1.60***	0.17***	1.31***
	(0.01)	(0.09)	(0.02)	(0.05)
Grandmother	1.41***	1.11**	1.25***	1.03
	(0.08)	(0.05)	(0.04)	(0.03)
Rural	10.53***	1.07*	8.29***	0.92**
	(0.43)	(0.04)	(0.24)	(0.02)
Constant	0.01***	0.05***	0.004***	0.07***
	(0.001)	(0.003)	(0.0003)	(0.003)
Observations	82,155	82,155	146,103	146,103

Robust standard deviations in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3B: Relative Risk Ratios (Men)

	2002		2010	
VARIABLES	Self-employed	Wage worker	Self-employed	Wage worker
Education;				
Primary School	1.20***	2.50***	1.78***	2.60***
	(0.06)	(0.14)	(0.06)	(0.08)
Secondary school	1.16**	4.06***	1.88***	4.21***
	(0.07)	(0.25)	(0.08)	(0.15)
High school	0.71***	3.24***	1.28***	3.21***
	(0.05)	(0.19)	(0.06)	(0.12)
Vocational high school	0.67***	5.02***	1.59***	6.03***
	(0.05)	(0.32)	(0.08)	(0.23)
University	0.58***	6.73***	1.16***	7.91***
	(0.04)	(0.42)	(0.06)	(0.30)
Number of children in the household;				
Age≤4	1.25***	1.47***	1.24***	1.64***
	(0.03)	(0.02)	(0.02)	(0.02)
5≤Age<11	1.26***	1.31***	1.21***	1.36***
	(0.02)	(0.01)	(0.01)	(0.01)
11≤Age<15	1.15***	1.15***	1.22***	1.20***
	(0.03)	(0.02)	(0.02)	(0.02)
Other members of the household;				
Number of wage workers	0.73***	1.13***	0.73***	1.02**
	(0.02)	(0.01)	(0.01)	(0.01)
Number of self-employed	0.22***	0.73***	0.35***	0.84***
	(0.01)	(0.02)	(0.01)	(0.01)
Number of unpaid family workers	6.20***	1.34***	6.94***	1.51***
	(0.38)	(0.08)	(0.27)	(0.05)
Marital status;				
Married	2.40***	1.66***	2.89***	1.44***
	(0.18)	(0.06)	(0.15)	(0.03)
Divorced	2.10***	1.19	2.28***	1.02
	(0.33)	(0.13)	(0.21)	(0.06)
Widowed	1.62***	0.48***	1.63***	0.31***
	(0.25)	(0.07)	(0.20)	(0.03)
Head of household dummy	2.05***	1.41***	1.76***	1.15***
	(0.12)	(0.05)	(0.06)	(0.02)
Rural	2.45***	0.89***	2.14***	0.76***
	(0.08)	(0.02)	(0.05)	(0.01)
Constant	0.09***	0.20***	0.04***	0.26***
	(0.01)	(0.01)	(0.002)	(0.01)
Observations	69,417	69,417	130,505	130,505

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

To examine the changes in returns to the human capital characteristics wage regressions are estimated for each year, separately for men and women. The regression results (see Table 4) show that coefficients for education decreased from 2002 to 2010 for both men and women. The coefficient for experience decreased for men while it increased slightly for women. The coefficient for the selection term is positive and statistically significant for both men and women; this is as expected the unobserved characteristics which increase the wages also increase the probability of choosing the wage employment.[9]

The descriptive statistics and the wage regressions show that as the composition of human capital of wage earners changed significantly between 2002 and 2010 and so did the returns to human capital. However, it is not possible to reveal to what extent these changes were responsible for the changes in the wage distribution without decomposing the changes in wage inequality. Tables 5A and 5B present the decomposition results for women and men respectively.

The top two rows of Table 5 give the measures of wage inequality for the two years. Wage inequality is higher for women than men. Whichever measure we look at, wage inequality decreased for both men and women over this period; the decrease is greater in the bottom part of the distribution (p50/p10) than the top half of the distribution (p90/p50).

[9] If we do not adjust for selection then the coefficients for education dummies and experience and experience square are much bigger, especially for women. Taking selection into account increases the gap between the 2002 and 2010 coefficients. Results are available from authors on request.

Table 4: Wage Regression Estimations with Selection

	Women		Men	
VARIABLES	2002	2010	2002	2010
Education;				
Primary School	0.20***	-0.05**	0.19***	0.01
	(0.05)	(0.02)	(0.02)	(0.01)
Secondary school	0.34***	-0.02	0.36***	0.06***
	(0.06)	(0.02)	(0.02)	(0.01)
High school	0.62***	0.13***	0.52***	0.21***
	(0.06)	(0.02)	(0.02)	(0.01)
Vocational high school	0.61***	0.11***	0.56***	0.18***
	(0.06)	(0.02)	(0.03)	(0.01)
University	1.12***	0.53***	1.05***	0.76***
	(0.07)	(0.03)	(0.03)	(0.01)
Experience	0.03***	0.04***	0.04***	0.03***
	(0.003)	(0.001)	(0.001)	(0.001)
Experience squared (10^{-3})	-0.82***	-0.76***	-0.85***	-0.27***
	(0.1)	(0.06)	(0.05)	(0.03)
Number of children in the household;				
Age≤4	-0.005	0.04***	-0.04***	-0.04***
	(0.02)	(0.01)	(0.01)	(0.003)
5≤Age<11	-0.02**	-0.01*	-0.01***	-0.02***
	(0.01)	(0.006)	(0.004)	(0.002)
11≤Age<15	-0.05***	-0.04***	-0.002	-0.01***
	(0.01)	(0.01)	(0.01)	(0.004)
Marital status dummies;				
Married	0.20***	0.22***	0.21***	0.19***
	(0.01)	(0.01)	(0.01)	(0.01)
Divorced	0.23***	0.14***	0.08	0.14***
	(0.03)	(0.01)	(0.05)	(0.02)
Widowed	0.24***	0.20***	0.01	0.19***
	(0.05)	(0.03)	(0.15)	(0.05)
Member of social security system	0.67***	0.36***	0.50***	0.30***
	(0.02)	(0.01)	(0.01)	(0.01)
Λ (selection term)	0.08**	0.25***	0.13***	0.15***
	(0.03)	(0.02)	(0.03)	(0.01)
Constant	4.01***	5.03***	4.29***	4.96***
	(0.08)	(0.04)	(0.04)	(0.02)
Observations	7,979	15,863	30,537	56,728
R-squared	0.565	0.580	0.437	0.491

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The decomposition results for both women and men (Tables 5A and 5B) suggest that the decrease in wage inequality in this period was mainly due to decreases in returns to observed characteristics (effect of coefficients; change in betas), and by a fall in the returns to the unmeasured characteristics (pricing function). Depending on the inequality measure these two factors explain almost all of the change in wage distribution, for both men and women. For women, however, the decrease in returns to unmeasured characteristics explains the fall in inequality in upper tails, while the decrease in inequality in the lower tail is explained more by the decrease in coefficients (returns to the measured characteristics).

The effect of changes in composition of characteristics is negative and relatively small for women. Change in characteristics (increase in education being one of them), holding returns same, decreases wage inequality for women. For men the same holds true, with the exception of changes in inequality in the upper tail, where a change in characteristics, holding returns same, leads to an increase in wage inequality. Part of the explanation for the differences in this finding for men and women could be due to the fact that proportion of women with university education (who are most likely to be in the upper tail) working in the wage sector is much higher than the proportion of men in the wage sector with university education. A further increase in the supply of educated women dampens the returns to them, whereas for men it doesn't[10].

The last rows of the tables present the residual change in the wage distribution which could not be explained by these three factors. Lemieux (2002) argued that when a random variable like y is the sum of two random variables like xb and u, knowing the distributions of these two variables is mostly not enough to characterize the marginal distribution of y.

[10] Robinson (1976) gives a two sector model where he shows there exist an inverted U-shaped relationship between wage inequality and the proportion of skilled labour; as the proportion of skilled labour increases wage inequality first increases and then decreases. The turning point of the relationship is an empirical question.

Generally, an infinite number of marginal distributions of y is compatible with given marginal distributions of xb and u.

The decomposition results for the changes in wage residuals for both women and men (Tables 5A and 5B) show that almost all of the changes in wage residuals are explained by the negative effect of change in pricing function. This is in accordance with the skill price theory of Lemieux (2002) who argued that the negative changes in the coefficients component exert a negative impact on the residual component along the wage distribution, providing a measure for unmeasured skills pricing.

Table 5A Decomposition of Changes in Wage distribution for Women

	p90/p10	**p90/p50**	**p50/p10**	**Gini coefficient**	**Theil index**
2002	1.46	1.21	1.20	0.09	0.013
2010	1.34	1.19	1.12	0.06	0.008
Total change	-0.12	-0.01	-0.08	-0.02	-0.006
%	(-8.9)	(-1.3)	(-7.5)	(-30.5)	(-76.5)
Effect of					
Coefficients	-0.08	-0.001	-0.06	-0.01	-0.003
	(-69.2)	(-6.3)	(-81.2)	(-55.7)	(-49.1)
Pricing function	-0.02	-0.02	0.0	-0.006	-0.002
	(-18.3)	(-112.5)	(0.0)	(-27.9)	(-33.0)
Covariates	-0.01	-0.003	-0.01	-0.002	-0.0005
	(-14.2)	(-18.7)	(-13.6)	(-7.8)	(-8.3)
Unexplained	0.002	0.006	-0.004	-0.002	-0.001
	(1.7)	(37.5)	(-5.2)	(-8.6)	(-9.6)

Note: percentage shares of each effect in total change are shown in parentheses

Table 5B Decomposition of Changes in Wage distribution for Men

	p90/p10	**p90/p50**	**p50/p10**	**Gini coefficient**	**Theil index**
2002	1.40	1.20	1.17	0.07	0.01
2010	1.31	1.18	1.11	0.06	0.006
Total change	-0.09	-0.02	-0.06	-0.01	-0.004
%	(-7.2)	(-1.7)	(-5.4)	(-27.7)	(-63.3)
Effect of					
Coefficients	-0.05	-0.018	-0.028	-0.009	-0.002
	(-55.8)	(-90.0)	(-46.5)	(-52.5)	(-47.6)
Pricing function	-0.03	-0.015	-0.01	-0.007	-0.002
	(-38.9)	(-75.0)	(-26.4)	(-43.0)	(-51.9)
Covariates	-0.008	0.002	-0.009	-0.001	-0.0002
	(-8.4)	(10.0)	(-15.7)	(-6.9)	(-6.2)
Unexplained	0.003	0.01	-0.007	0.0004	0.0002
	(3.2)	(55.0)	(-11.4)	(2.3)	(5.7)

Note: percentage shares of each effect in total change are shown in parentheses

Table 6A Decomposition of Changes in Wage Residuals (Women)

	Variance	**90-10**	**90-50**	**50-10**
2002	0.31	1.28	0.64	0.63
2010	0.20	1.04	0.52	0.52
Total change	-0.11	-0.24	-0.12	-0.11
%	(-58.1)	(-23.3)	(-24.5)	(-22.1)
Effect of				
Covariates	0.01	0.01	0.005	0.01
	(6.1)	(6.5)	(4.1)	(9.1)
Pricing function	-0.12	-0.25	-0.13	-0.12
	(-106.1)	(-106.5)	(-104.1)	(-109.1)

Note: percentage shares of each effect in total change are shown in parentheses

Table 6B Decomposition of Changes in Wage Residuals (Men)

	Variance	**90-10**	**90-50**	**50-10**
2002	0.31	1.32	0.67	0.64
2010	0.19	1.08	0.56	0.51
Total change	-0.11	-0.23	-0.11	-0.13
%	(-59.4)	(-22.0)	(-19.2)	(-25.1)
Effect of				
Covariates	-0.0004	-0.01	0.01	-0.01
	(-0.4)	(-2.4)	(6.8)	(-10.2)
Pricing function	-0.11	-0.23	-0.11	-0.11
	(-99.6)	(-97.6)	(-106.8)	(-89.8)

Note: percentage shares of each effect in total change are shown in parentheses

6. Conclusion

In this study, the relationship between human capital composition of employment and wage inequality is investigated using data on the Turkish labour market. Using the decomposition methodology proposed by Lemieux (2002), it is found that the decreasing wage inequality observed in Turkey between 2002 and 2010 were mainly due to two factors: the decreasing between group inequality which is related to decreasing coefficients for education and the decreasing within group inequality due to decreasing skill pricing function of unmeasured skills. On the other hand, the role of change in distribution of covariates is found to be small.

The results of the analysis show that changes in wage distribution in Turkey cannot be explained with the popular skill-biased technological change paradigm and support the main hypothesis of the study that that the wage inequality decreases as a result of a fast increase in the supply of educated labour in an environment of stagnant or slowly increasing demand for it.

The robustness of the results is also checked by using the quintile decomposition methodology proposed by Melly (2005) and residual imputation methodology proposed by Juhn, Murphy and Pierce (1993). Qualitatively similar results are found since the main difference in these models is on the computation of effect of changes in covariates which has a small magnitude in here. We also did robustness checks by looking at the period 2002-2007, to avoid the period of global slowdown since 2008. The results obtained are qualitatively similar to those reported here. (Details are available from the authors on request).

As a consequence of the increasing number of universities and reforms in educational system, the supply of educated labour increased rapidly in Turkey. However, steep decreases in returns to education and an increasing share of university graduates in unemployment show that the labour market could not accommodate the increasing supply. Accordingly, wage inequality decreased as a result of a crowding out effect of stagnant skill demand on educated labourers.

The results of the study indicate that the decreasing skill premium led to a substantial change in the skill pricing function of unmeasured characteristics as well. The change in skill pricing function can be interpreted as sign of quality differences between universities. This is not a surprising result since new universities encounter financial difficulties and lack of facilities such as laboratories and buildings. Unfortunately, this hypothesis is not testable since there is no information in the dataset about the universities that individuals graduated

from. However, there is evidence that the quality of education is decreasing in general. For instance, according to Student Selection and Placement Centre (OSYM) higher education statistics, the number of students per teaching staff increased from 13.8 in 1984 to 18.8 in 2011. In fact, the establishment of new universities under the "a university in each city'' project is criticized by many authors (Dortlemez 1995; Kaynar 2005). It is argued that the scientific requirements and maintenance of minimum standards have been ignored as politicians used stimulating effects of universities on local economies in their election campaigns. Decreasing quality of university education has two crucial economic outcomes; it reduces the productivity of the educated labour and causes inefficient allocation of resources which is quite limited in many developing countries.

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