

GENDER-UNION WAGE GAP IN SOUTH AFRICA: AN UNCONDITIONAL QUANTILE REGRESSION & COARSENEDED EXACT MATCHING APPROACH



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Abstract

South African women have been fairing badly in the labour market compared to their male counterparts since pre-colonial times due to both cultural and legal restrictions (and discrimination). Despite the corrective measures (e.g. legislation changes) that were introduced by the South African government post-apartheid to improve women's social status, labour market conditions remain unfavorable for women. Labour unions are actively advocating for gender equality as well as higher and more equitable salaries. However, the extant literature on unions and wages pay more attention on the impact of unions and wages. There is paucity of literature on the moderating role of unions on the gender-wage inequality.

This study contributes to the literature by investigating the impact of labour unions on the gender-wage inequality in South Africa, using the National Income Dynamics Study (NIDS) data obtained from the DataFirst website for the 2008 to 2017 waves. Furthermore, this study uses more recent econometric techniques, viz. unconditional quantile regression (UQR) and coarsened exact matching (CEM) methods with interaction effects, on a panel of 12,881 individuals. These methods are superior than the ones used in the extant literature as they control individual heterogeneities, sample attrition and selection bias that may arise from individuals' decisions to join unions.

Both the CEM and UQR results suggest a strong positive relationship between unions and wages in South Africa. In addition, both models suggest that labour unions narrow down the existing gender-wage gap in South Africa. However, this impact is weakened at higher-ends of the income distribution as the magnitude by which unions reduce the gender-wage gap reduces at higher percentiles (i.e. the 75th and 90th percentiles). This is possibly due to high-income earners being individuals with higher productive abilities (such as higher levels of education and additional skills) and therefore having more bargaining power to negotiate their own wages in the absence of unions. Another possible explanation could be that high-productive abilities are a signal to employers that an individual will be able to do the job better than individuals with low productive abilities. This leads to employers being able to better estimate wages for such individuals outside the bargaining power of unions. These findings are important as they indicate that either unions have a weakened bargaining power for high-income earners, or that the high-income earners experience less gender-wage discriminations. It is therefore worthwhile for policymakers to analyse such trends before implementing "one-for-all" union policies and other related policies aimed at reducing gender inequality.

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Dedications

To my family and future generation, nothing is impossible in this life!

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1. Background and Introduction

Women have been fairing badly in the South African labour market since pre-colonial times, with agriculture being the only sector where women had social status and authority through land allocation rights by chiefly authorities (Baden, Hasim, & Meintjes, 1998; Hutson, 2007). However, that social status was eroded by the implementation of colonial state interventions “which restructured the homestead economy to serve the migrant labour system” (Baden et al., 1998, p. 6). This made agriculture less attractive and viable for women as they were robbed of their land allocation rights (Walker, 1990, p. 8). Following these colonial developments, women started moving to urban areas for better employment opportunities. However, the employment laws and regulations were unfavorable to women, leaving them with fewer employment options such as beer brewing, being domestic workers and working on farms (Baden et al., 1998; Hutson, 2007).

The end of apartheid in South Africa brought in a new democratic government, which introduced a legal framework more favorable to women (e.g., employment equity legislation and the country’s constitution). Despite these changes, lack of opportunities and bias (even discrimination) against women still persists, especially when it comes to employment opportunities. According to Mosomi (2019), compared to men, women are over-represented in low-paying jobs such as domestic services, finance (bank tellers and customer information clerks), trade (roadside traders) and services (technical assistance) between 1995-2015. Dex (1985) found a similar trend with the majority of women occupying jobs in marginalized sectors. This marginalization of women is worrying considering that almost half of the South African households are female-headed (Galal, 2021; Posel, 2001, p. 659). This historic disposition of women in South Africa led to significant wage disparities between men and women (Cheru, 2001).

South African literature on the gender-wage gap started gaining momentum post-apartheid, partly due to increased female participation in the South African labour force as well as changes in “employment equity legislation on the representation and treatment of women in the labour market” (Bhorat & Goga, 2013). A number of studies suggest that female wages in South Africa remain persistently below those of their male counterparts, though the wage differential between the two genders has been declining over the years (see, Adelekan & Bussin, 2018, p. 9; Adelekan & Bussin, 2022, p. 3; Casale & Posel, 2011, pp. 42-48; Kollamparambil & Razak, 2016, p. 58;

Muller, 2009, p. 6; Ntuli, 2009a, p. 11; Olsen & Walby, 2004, p. 8; Shepherd, 2008, pp. 21-24). As much as most South African studies suggest a declining gender-wage gap, Ntuli (2009a) found the gender-wage gap to be widening at higher-ends of the income distribution for the period 1995 to 2004, partly due to women experiencing more discrimination at the upper end of the earnings distribution. These conflicting views in the literature are possibly due to different analytical methods used in the extant studies, which may bring about difficulties in comparing the empirical results across studies (Ntuli, 2009a, p. 2). It is surprising that the gender-wage inequality still exists even after more than twenty years of democracy and the dismantling of many forms of discrimination in South Africa. Posel (2001, p. 165) suggests that this is due to labour migration and non-marriage.

The marginalization of women is not only unique to South Africa. Internationally, Kim (2013) and Polachek (2004) also found the gender-wage gap to be narrowing down in the United States (from females earning about 70% less than their male counterparts in 1995 to them earning only 20% less between 2000 – 2001) even though female wages remain below those of their male counterparts. In Australia, Belgium, Italy, Sweden, Canada and Japan, female wages are about 60% of men's earnings (Polachek & Xiang, 2006).

It is surprising that the gender-wage inequality still exists even after more than twenty years of democracy in South Africa. Trade unions have been actively trying to promote equity and justice in the labor market (Levy, Bendeman, Bronwyn, & Robert, 2014, p. 426). Specifically, the goals of trade unions across the world is to promote “higher and more equitable salaries” as well as “gender equity and parental rights” (Finnemore & Koekemoer, 2018; Fleisher, 1970). Section 23 of the Labour Relations Act of South Africa defines a trade union as “an association of employees whose principal purpose is to regulate relations between employees and employers, including any employers’ organizations”.

It is worthwhile to investigate whether unionisation reduces the gender-wage gap and to some extent helps to address poverty and inequality towards women. Research shows that unionisation can help reduce the gender-wage gap, though this depends on various factors such as the presence of equal job qualifications, equal access to education and training, parenthood and collective bargaining (Meara, Pastore, & Webster, 2020; Olsen & Walby, 2004). Unions also often recognize and enforce equal pay for equal work policies, which can help minimize wage disparities between male and female employees. Additionally, unions can create and negotiate employer-specific

policies that protect or benefit female employees, thus reducing the likelihood of earning disparities based on gender.

Studies show that unions are generally associated with higher overall wages for all workers (see, Butcher and Rouse (2001), Casale and Posel (2011), Kollamparambil and Razak (2016), Kwenda and Ntuli (2018), Ntuli (2009a), Ntuli and Kwenda (2014), Polachek (2004), Schultz and Mwabu (1998), Siebert (1987)), which helps narrow wage disparities and reduces wage inequality between genders. Furthermore, Ntuli (2009a), Schultz and Mwabu (1998) found that even though the overall impact of unionisation on wages is a positive one, the impact is larger at the lower end of the income distribution and smaller at the higher end. This raises a question of whether the influence of unions is weakened for high-income earners.

Despite the positive impact of unions on wages, it is not clear whether in South Africa, unionisation has been able to reduce the gender-wage gap in the workplace as this has not been widely researched. With the exception of a study by Casale and Posel (2011), who found the gender-wage gap for union workers to be higher than non-union workers, thus suggesting that unions increase the gender-wage gap. This is possibly due to men being rewarded for their productive capabilities at a higher rate than women, “even though unionized women have a better set of productivity-related endowments than men” (Casale & Posel, 2011, p. 47).

This study extends Casale and Posel (2011)’s work by using a different dataset (the National Income Dynamic Study (NIDS) data compared to the Labour Force Surveys used in the aforementioned study). NIDS is one of the longest panel data surveys in South Africa. In addition, this study extends the literature by using a more recent timeline (2008 – 2017), which will aid policymakers in determining whether their collective bargaining initiatives have actually benefited women over the years considering how badly they have been fairing in the labour market. This study also seeks to contribute to the debate as to whether the gender-wage gap has been narrowing down over the years in South Africa through investigating the role of unions in the gender-wage gap compression.

In light of individual heterogeneities and the possibility of selection bias arising from individuals choosing whether or not to join trade unions or employers deciding which employees may join unions (Casale & Posel, 2011) and the possibility of simultaneity (and endogeneity), this study uses an unconditional quantile regression (UQR) technique with interaction effects. This is a relatively new technique proposed by Firpo, Fortin, and Lemieux (2009) and it builds onto the

conditional quantile regression method proposed by Koenker and Bassett Jr (1978); Koenker and Hallock (2001). UQR is more flexible than the aforementioned analytical methods since it does not require any stringent assumptions to be made and corrects for data heterogeneity, reduces the effects of endogeneity and controls for selection bias. Furthermore, the UQR model helps determine the effect of unions on wages at different points of the wage distribution. This is important as Casale and Posel (2011); Ntuli (2009a); Schultz and Mwabu (1998) found unions to have a smaller impact on wages at higher-ends of the income distribution. The interaction effects will help flesh out whether unions narrow down the gender-wage gap.

The study employs the coarsened exact matching (CEM) technique of Iacus, King, and Porro (2012) as an alternative method. This matching technique is simple and superior to other matching techniques such as the propensity score matching (PSM) and Mahalanobis distance as it balances the data by automatically restricting the matched data to areas of common empirical support and meets the congruence principle (Iacus et al., 2012). Furthermore, it overcomes the problem of high dimensionality in exact matching and results in a larger sample size.

For a country marked by social ills like South Africa, it is important that the government works towards promoting social cohesion. South Africa has many female-headed households, therefore solving for the gender wage inequality will help improve the livelihoods of many South Africans since employment is one of the largest sources of livelihoods for many individuals in the country. Studies such as this one will help policymakers to make informed decisions on whether implementing union policies aimed at reducing the gender-age gap is worthwhile. The analysis used in this study can also be extended to other social interventions aimed at achieving equality and reducing poverty such as social grants.

1.1. Contribution of the study and research aims

The extant literature in South Africa investigates the presence of a gender-wage gap and the impact of trade unions on overall wages (see, Bhorat & Goga, 2013; Butcher & Rouse, 2001; Casale & Posel, 2011; Kerr & Wittenberg, 2021; Kollamparambil & Razak, 2016; Mosomi, 2019; Muller, 2009; Ntuli, 2009b; Schultz & Mwabu, 1998). With the exception of Casale and Posel (2011), there is paucity of studies that investigate whether unions narrow the gender-wage gap in South Africa or not, e.g. Casale and Posel (2011) who find that the gender wage differential in the union sector is actually higher than in the non-union sector after controlling for industry and occupation. This paper extends the analysis in Casale and Posel (2011) by controlling for more unobservables

using quantile regression and matching methods which are more superior for a study with possible selection bias.

1.2. Research Questions

This study addresses the following questions:

1. Is there a gender-wage gap in South Africa?
2. Does unionisation affect wages in South Africa?
3. Do trade unions narrow down the gender-wage gap?

2. Literature Review

This paper is grounded in gender-wage discrimination theories. These discrimination theories can be divided into collective (where individuals act collectively against each other) as well as competitive (focused on individuals' maximizing behavior) models. Competitive models can be further divided into statistical models of discrimination as well as taste-based models. This study focuses on competitive (both statistical and taste-based) models as it uses data on individual workers.

Gender wage discrimination theories

The taste-based theory of Becker (2010) argues that discrimination arises from the taste of members of a particular group, say group A (it could be an employer, fellow employees, customers or a particular race or ethnic group) towards a minority group, say group B (it could be fellow employees, women or a particular ethnic or racial group). This study looks at the case where employers, male co-workers and customers discriminate against female employees.

The implication of the taste-based theory is that firms are likely to employ a male worker than a female who possesses the same productive capacity and that females are likely to accept lower wages as a consequence, leading to wage differentials (Autor, 2003). Similarly, customers may prefer to be assisted by male workers over female workers (e.g. a car salesman). This prejudice by customers and co-workers devalues the worth of female employees and forces them to accept lower wages than their male counterparts (Autor, 2003). This also forces females to accept jobs with less stability (and unionisation).

Therefore, if there are less prejudiced employers, customers or co-workers gender-wage discrimination will reduce. Furthermore, Autor (2003) suggests that if the job market is perfectly competitive, the gender-wage discrimination from employer prejudice will reduce. However,

Ntuli (2009b) suggests that due to the South African industrial structure not being very competitive, “there are lesser chances that discrimination may be competed away”, which suggests a case for this study to use the taste-based discrimination theory in explaining the potential evidence for gender-wage discrimination in South Africa as suggested by Casale and Posel (2011); Muller (2009); Ntuli (2009b); Shepherd (2008). Perhaps trade unions, through their mandate will eradicate gender-wage discrimination brought about by prejudiced employers and market conditions.

The statistical discrimination theory is an alternative to the taste-based discrimination theory. According to Ntuli (2009b), the authors who made the theory popular are *inter alia* Aigner and Cain (1977), Lundberg and Startz (1983) and Phelps (1972). The statistical discrimination theory implies that employers may discriminate against women employees due to imperfect information about the productivity and labor force participation of prospective employees present in the labor market. As a result of this, employers rely on an applicants’ average characteristics when making employment decisions (Autor, 2003). Employers will then offer females low-paying and unstable jobs with few to no opportunities for unionisation.

Given the historical and cultural context of the South African female population being forced to take care of domestic duties and the slow uptake of education especially in tertiary level, labor force participation rates have been low for females in technical and leadership roles (Walker, 1991). Dormehl (2012) found that women make up only 3.6% of chief executive officer and managing director roles and for director, chairperson and executive management roles, women make up 17.1%, 5.5% and 21.4% respectively. Forbes (2019) found that only 22% of Information Technology leaders are women. This is likely to be one of the contributors of the gender wage differential. However, Casale and Posel (2011) find the gender wage gap to persist even after controlling for occupation and industry. This then raises an important question of whether the occupation and industry controls are limited.

Human Capital Theory is based on the premise that “education increases the productivity and earnings of individuals; therefore, education, is an investment” (Tan, 2014). The mechanism through which education is positively correlated with wages is that an increase in education leads to an increase in skills, and an increase in skills leads to an increase in productivity, which is rewarded through higher earnings and attractive employment opportunities such as options to join unions. During apartheid in South Africa, the proportion of women in South African universities

has been below 50% (Hill & King, 1993; Unterhalter, 1990). It was only post-apartheid South Africa when “gender parity ratios show a stronger tendency towards female education attainment of higher levels of education than males in nearly all age categories” (StatsSA, 2004-2014). In this case, even though men and women have the same abilities, women are stuck in marginalized low-paying jobs (e.g., part-time non-union jobs) due to them being deprived of opportunities to obtain higher levels of education during apartheid.

The segmented labour market theory is of the implication that jobs and labour are divided into labour market segments; and workers and jobs are not matched by a universal market mechanism (Dickens & Lang, 1993). The theory further states that the labour market is divided into “good jobs”, characterized by higher wages, stable labour market conditions, job security, unionisation, higher salaries and benefits, high qualification levels and more career opportunities, and “bad jobs”, characterized by low wages, low qualification levels, unstable working conditions, less career opportunities and less opportunities to unionise (Kumaş, Çağlar, & Karaalp, 2014). Due to limited opportunities to study further for females and anticipated breaks in their career, females may be forced to settle for “bad jobs” with low salaries and no unionisation regardless of their productive capabilities.

The above-mentioned theories attempt to explain the discrimination and lack of opportunities faced by women in the labor market. Trade unions, through their mandate aimed at promoting equity minimize such discriminations and achieve fairness in the labor market. This study will assess the effectiveness of unions in South Africa by testing whether they close the gender-wage gap (if it exists in South Africa). To the best of our knowledge, there is dire literature empirically testing the effectiveness of trade unions in promoting equity in the labour market. Therefore, this study will contribute to the literature in that regard.

Theories about an individual's decision to join a union

The demand and supply model (also known as the cost-benefit theory) was made popular by (Ashenfelter & Johnson, 1972; Ashenfelter & Pencavel, 1969; Berkowitz, 1954; Pencavel, 1971). This model views unionisation as a service-providing asset to workers who aim to maximize their utility (Hirsch & Addison, 1986, p. 29). Since it takes time to realize the gains of joining a union, unionisation may be viewed as both a cost and an investment. The model implies that the greater the union-wage premium and non-monetary benefits of joining a union, the higher the likelihood of an individual to join a union (Schnabel, 2002). However, Olson (2012) highlights that free-

riders may benefit from unions since wage increases from collective bargaining benefit everyone regardless of their union status. On the other hand, the non-monetary benefits of collective bargaining such as grievance procedures and job security only apply to the unionized. Therefore, Olson (2012) suggests that the model lacks clarity on why individuals would still choose to join a union even if they have an option to free ride. Ntuli (2009b) highlights that since the Labour Relations Act of South Africa permits employers to deduct fees from the non-union workers, which may be equal to the subscription fees of unions. This therefore reduces the incentive for individuals to free-ride.

The possible limitations of the demand and supply model gave rise to alternative theories such as the social custom view. The implication of this theory is that workers join unions because of the satisfaction they get from being unionized (Schnabel, 2002). Therefore, a union can be successful even in the presence of the free rider problem (Booth, 1983; Naylor, 1990). Furthermore, Schnabel (2002, p. 7) argues that “workers may be prepared to join a union if others are joining”. However, Ntuli (2009b) argues that the setback of the social custom view is that the only available information is on whether an individual is unionized, not on their choices. Furthermore, Ntuli (2009b) highlights that the lack of data to test the theory is another drawback.

Regardless of the limitations of the demand and supply model and the social custom view, they are useful in explaining the possible selection bias that may arise when individuals join a union. This is motivation for this study to use covariate balance propensity score matching to address this possible selection bias.

3. Data and model specification

3.1. Data Sample and Source

A panel data is constructed using the National Income Dynamics Study (NIDS) data obtained from the DataFirst website from the 2008 to 2017 waves. NIDS is one of the longest panel data surveys on South African individuals examining the dynamics of socioeconomic issues such as poverty and unemployment. NIDS is conducted in five waves, starting in the year 2008 with a sample of 28 000 individuals from 7 300 households and ending in the year 2017. The same individuals and households are tracked and interviewed every two years. The exception was in 2017 when an additional 2 755 individuals were added to the sample due to the “attrition of White, Indian/Asian and high-income respondents” (Brophy et al., 2018). Wave 1 started in 2008, Wave 2 in 2010-2011, Wave 3 in 2012, Wave 4 in 2014-2015 and Wave 5 in 2017.

Since this study aims to investigate whether a gender-wage gap exists in South Africa and whether unions narrow down the gender-wage gap if it exists, unemployed individuals are excluded. Furthermore, individuals who are younger than 15 years or older than 64 years are excluded since they do not form part of the South African labour force (StatsSA, 2022). Individuals who reported zero wages are also removed from the sample. After these exclusions, the sample size for this study sample size consists of 12 881 individuals. Of the 12 881 individuals, 6 046 are males and 6 835 are females.

The main variable of interest is unionisation (*No_Union*). It is a dummy variable that assumes a value of one if an individual responded “no” to the question “do you belong in a union?” in the NIDS questionnaire, and zero if the individual’s response was “yes”. Earnings (Y_i), the logarithm of an individual’s gross monthly pay is the dependent variable. Similar to Budig and Hodges (2010); Killewald and Bearak (2014), the income is not adjusted for inflation. The definition of covariates is in Table 6 in the appendix. The covariates are based on the individual’s responses to the NIDS questionnaire.

3.2. Model specification and econometric analysis

Justification of covariates

The model controls for occupation because wages in South Africa differ across occupations. The categories within occupation variable are taken from the NIDS database. Bhorat (2000) found that managers and professionals are the highest paying occupations in South Africa whilst agriculture and machine operators form part of the lowest-paying occupations. Furthermore, Casale and Posel (2011) found that in South Africa, unionized workers are more likely to be in managerial and professional occupations (with males having a higher likelihood than females) whilst workers who are not part of a union are more likely to be in elementary occupations, crafts and sales (with females having a relatively higher likelihood than males). A similar argument holds for *industries*; earnings tend to differ across industries. Bhorat (2000) found that financial institutions are the highest paying industries whilst agriculture and mining are the lowest paying industries.

Furthermore, Casale and Posel (2011) found that “union jobs are much more likely than non-union jobs to be in the public sector”. The study controls for *tenure* because earnings tend to increase as the number of years an individual has worked in a company increase. Casale and Posel (2011) find a positive relationship between earnings and tenure. *Population group* is included because in South

Africa, wages tend to differ among the different ethnic groups. Shepherd (2008) find that Africans experience more wage discrimination than whites and coloureds.

Tenure is controlled for because older individuals with more work experience tend to earn higher wages than young individuals. *Education* is controlled for because higher levels of education leads to an increase in skills, which leads to an increase in one's productivity and higher productivity is rewarded through higher earnings. Tolley and Olson (1971) find a significant positive relationship between earnings and income. Furthermore, de Wolff and Van Slijpe (1973) argue that education is one of the biggest determinants for income variations. Consistent with Mlatsheni and Ranchhod (2017, p. 16), education levels below a Bachelor's degree are collapsed together.

The parent's level of education is included because individuals with more educated parents tend to receive higher wages than those with less educated parents. This study uses *mother's education* only since in South Africa, more than 90% of children stay with their biological mothers whilst only 31.7% of African children stay with their biological fathers. 51.3% of coloured stay with their biological fathers whilst for Asians/Indians and whites, the percentage of children who stay with their biological fathers is 86.1% and 80.2% respectively (News24, 2021). Therefore, including the father's education may lead to biased results. Flouri and Hawkes (2008) found that individuals who were raised by ambitious, educated mothers tend to have positive outcomes (including labour market outcomes) even in their adult life.

Whether an individual is *permanently employed* is controlled for because permanently employed individuals may experience higher earnings and fringe benefits. *Province* is controlled for because wages in provinces where economic hubs are located may differ from wages in provinces that have less economic activity. Shepherd (2008) suggests that provinces with large metropolitan areas tend to positively impact wages whereas provinces containing old homesteads tend to negatively affect wages.

3.3. Research design and econometric techniques

Ordinary Least Squares (OLS) model

This study investigates whether a gender-wage gap exists in South Africa for the years 2012 – 2017. Furthermore, the study examines whether labour unions narrow down the gender-wage gap if it exists. In order to answer the first question, an OLS model is estimated in equation 1 as follows:

$$Y_{it} = \beta_0 + \beta_1 NO_UNION_{it} + \beta_2 FEMALE_{it} + \sum_{i=1}^k \beta_i X_{it} + \varepsilon_{it} \quad \dots(1)$$

Where Y_{it} is an individual's income, NO_UNION_{it} is the union dummy which is set to one if an individual does not belong to a union and zero otherwise. $FEMALE_{it}$ is the gender dummy which assumes a value of zero for males and one for females. X_{it} is a set of covariates, namely, tenure, education, mother's education, province, population group, industry and occupation. The occupation and industry categories are taken from the NIDS dataset. β_0 is the intercept, β_1 is the union premium and β_2 represents the gender-wage gap. β_i is the premium associated with each covariate.

To answer the second question, “*do labour unions narrow the gender-wage gap?*”, the OLS model in equation (1) is modified and estimated with an interaction term between gender and union as follows:

$$Y_{it} = \beta_0 + \beta_1 NO_UNION_{it} + \beta_2 FEMALE_{it} + \beta_3 FEMALE * NO_UNION_{it} + \sum_{i=1}^k \beta_i X_{it} + \varepsilon_{it} \quad \dots(2)$$

β_3 in equation 2 represents the interaction effect and helps flesh out the moderating role of being a union member on the gender-wage gap. ($\beta_2 + \beta_3$) captures the joint impact of not being in a union for female workers, in compressing or widening the gender wage gap relative to the gender variable main effect, β_2 .

Unconditional Quantile Regression (UQR model)

The OLS model gives an incomplete analysis since it only analyses data around the mean which might not be appropriate when one looks at the impact of unionisation on the entire unconditional wage distribution. Moreover, the OLS model does not control for the selection bias that may arise from individuals choosing whether or not to join a union (as suggested by the cost-benefit theory and social custom view) or employers deciding which employees may join unions (Casale & Posel, 2011). Furthermore, according to Ntuli (2009a), “higher earnings result in a higher propensity to join a union, but being in a union can result in higher wages”. Therefore, in order to nuance the distributional effects of unions on wages suggested by Ntuli (2009a) and Schultz and Mwabu (1998) and selection bias suggested by theory as well as to make this study comparable with the extant literature, an unconditional quantile regression (UQR) technique (Firpo et al., 2009) and the coarsened exact matching (CEM) (Iacus et al., 2012) technique are employed as alternative

models. Furthermore, UQR will control for the sample attrition arising from some individuals dropping out of the sample (Harding & Lamarche, 2019, p. 3).

The UQR model is estimated using the OLS models specified in equations (1) and (2) on the transformed value of income, formally called the recentered influence function (RIF) (Firpo et al., 2009). The RIF is defined as follows:

$$RIF(Y_{it}; q_\tau, F_{Y_{it}}) = q_\tau + (\tau - I\{Y_{it} \leq q_\tau\}) / f_{Y_{it}}(q_\tau) \quad \dots(3)$$

Where τ represents a given quantile, q_τ is the value of the logarithm of income, Y_{it} , at the τ^{th} quantile. $f_{Y_{it}}(q_\tau)$ is the density of Y_{it} at point q_τ and $F_{Y_{it}}$ is the cumulative distribution function of income (i.e. the probability distribution of income). I is the indicator function.

For instance, when estimating the gender-wage gap at the median of the income distribution ($\tau = 0.5$), the median income in the sample will therefore be an estimate of q_τ . The estimated density of the income distribution at the median income is an estimate of $f_{Y_{it}}(q_\tau)$ using a kernel density estimator and creating a dummy variable $I\{Y_{it} \leq q_\tau\}$ which indicates whether an individual's income is below the median income in the sample (q_τ). This implies that the UQR model measures the impact of each covariate on the distribution of income and specifies the quantile pre-regression (Killewald & Bearak, 2014). Furthermore, the UQR captures both within-group effects (i.e. differences between a group of individuals who have the same values of covariates) and “between-group effects linked to the fact that unions increase the conditional mean of union workers” (Firpo et al., 2009). An OLS regression of the new transformed income variable (obtained from the RIF) will then be estimated, controlling for the covariates. Due to the possibility of autocorrelation of the residual term as a result of multiple observations for every individual in the sample, the standard errors will be bootstrapped. The following five quantiles of the income distribution are analyzed: the 10th percentile (0.1), the lowest quartile (0.25), the median (0.5), the highest quartile (0.75) as well as the 90th percentile.

Coarsened Exact Matching (CEM) method

Coarsened Exact Matching (CEM) method is a matching technique by Iacus et al. (2012). This study seeks to investigate the impact of unions (a discrete variable) on the wage disparities (continuous variables) between males and females. The CEM method is an appropriate matching method as it allows researchers to match individuals based on continuous variables such as wages,

which other matching methods struggle with (Hedija, 2015; Iacus et al., 2012). This is done by defining an outcome variable (log of monthly wages and log of hourly wages on this case) and a treatment variable (union in this case). A control group from the untreated (non-union) group, that is as identical as possible to the treated (unionized group) is selected and tested whether there are statistically significant differences between the two groups (Meara et al., 2020). To test the existence of a gender-wage gap, equation 2 is estimated without an interaction between gender and union and to test whether the gender-wage gap (if it exists) narrows down with unionisation, equation 2 is estimated with an interaction between gender and union.

4. Estimation and discussion of results

4.1. Univariate analysis

Table 1 presents the descriptive statistics (means) of all the variables used in this study by gender, as well as the tests for the mean differences between males and females.

The results in column 2 suggest that the average monthly income for the individuals in the sample is R3 294.50 ($e^{8.10}$). When considering gendered differences, the data suggests that males earn significantly higher than females (p value = 0.000). For instance, the average monthly income for males is R3905 ($e^{8.27}$) and that of females is R2807 ($e^{7.94}$). Furthermore, the average monthly income for unionized males is about R7 186.79 per month and the average monthly income for males who are not in unions is about R2 790.57 per month. Females who are in unions earn about R6 768.26 on average and females who are not in unions earn about R1 923.69. This implies that unionized individuals earn more than those who are not in unions. Furthermore, the summary stats suggest that males generally earn more than females in both the union and non-union sectors.

For the research variable, *union*, the data suggests that the majority of females in the sample are not part of unions. Furthermore, there is a significant difference between males and females who are not in unions (p value = 0.000). For the control variables, males have significantly higher levels of tenure compared to females and the majority of females in the sample reside in provinces other than Gauteng and the Western Cape when compared to males.

A significant majority of males are in occupations such as managers, technicians, skilled agriculture, clerks, elementary, crafts and sales. Consistent with Mosomi (2019), Dex (1985), Colgan and Ledwith (2002) the only occupation where females form a significant majority is professionals. Furthermore, the only industries with the majority of female workers are financial institutions and agriculture. The other industries (mining, manufacturing, electricity, construction and transport as well as the public sector) are male dominated. In addition, more males are permanently employed as compared to females. These significant mean differences between males and females suggest that there may be systematic differences between the two groups that could potentially influence their earning and employment outcomes. However, these preliminary findings need to be interpreted with caution as they are based on univariate analysis, which does not control for the effect from other variables. Table 1A presents the union membership trends

over the 5 waves (2008 – 2017). The majority of the individuals in the sample are non-union members. For instance, only 27% of the individuals formed part of unions in 2010. Furthermore, the majority of unionized individuals in the sample are males. A possible explanation to this is females being forced to accept unstable jobs that don't encourage union participation due to being deprived educational opportunities and career growth opportunities that their male counterparts had as suggested by the human capital theory. Furthermore, due to anticipated career breaks from motherhood and household responsibilities, employers could be discriminating against females and offering them unstable jobs with little to no opportunities to join unions compared to their male counterparts.

Table 1: Summary statistics of means of all variables and p-values of the mean differences between males and females

Variable	Whole Sample	Whole Employees			Union			Non-union		
		Males	Females	P-value	Males	Females	P-value	Males	Females	P-value
Income	8.1	8.27	7.94	***	8.88	8.82	**	7.934	7.562	***
Tenure	6.53	6.47	6.34		12.06	12.54		6.856	6.71	
Tenure squared	109.36	112.5	96.77	***	247.66	244.17		117.28	97.806	***
Degree and Postgrad	0.15	0.15	0.15		1.18	1.27		1.117	1.1167	*
Other Provinces (Gauteng is the base)	0.8	0.78	0.81	***	1.704	1.703		1.691	1.71	
Educated Mother (base is uneducated mother)	0.47	0.51	0.44	***	0.55	0.64		0.52	0.51	
African (base is races other than blacks)	0.84	0.84	0.84	**	0.802	0.772	*	0.75	0.76	
Managers	0.04	0.05	0.03	***	0.06	0.04	***	0.045	0.025	***
Professionals	0.12	0.07	0.17	***	0.12	0.35		0.044	0.0993	
Technicians and Machines	0.14	0.22	0.07	***	0.27	0.1	***	0.206	0.053	***
Clerks, Elementary, Crafts and Sales	0.68	0.63	0.72	***	0.55	0.51	***	0.689	0.816	
Skilled Agriculture	0.01	0.01	0	***	0.021	0.017		0.012	0.006	***
Unspecified Duration	0.3	0.29	0.31	***	0.094	0.095		0.372	0.389	
Permanent	0.54	0.56	0.52	***	0.833	0.811	**	0.428	0.412	***
Agriculture	0.12	0.16	0.08	***	0.049	0.03	**	0.206	0.106	***
Mining, Manufacturing, Electricity, construction and transport	0.24	0.37	0.13	***	0.38	0.148	***	0.359	0.12	***
Wholesale and Retail	0.17	0.15	0.19	**	0.1	0.146		0.181	0.212	
Financial Institutions	0.08	0.09	0.07	***	0.078	0.063	**	0.086	0.071	***
Public Sector	0.29	0.21	0.37	***	0.397	0.597		0.133	0.277	
No_Union	0.72	0.7	0.74	***						

Source: Author's own calculations. *** p<0.01, ** p<0.05, GP-Gauteng Province, WC –Western Cape Province,

Table 2A: Union membership by gender in South Africa (2008 – 2017)

Year	Whole Sample		Males		Females	
	Union	Non-Union	Union	Non-Union	Union	Non-Union
2008	30.38%	69.62%	30.38%	69.62%	24.80%	75.20%
2010	27.01%	72.99%	29.70%	70.30%	24.63%	75.37%
2012	28.68	71.32	31.10%	68.90%	26.49%	73.51%
2014	28.20%	71.80%	30.85%	69.15%	25.83%	74.17%
2017	27.06%	72.94%	30.02%	69.98%	24.75%	75.25%

Source: Author's own calculations.

4.2. Main Results

This study investigates whether a gender-wage gap exists in South Africa for the period 2012 – 2017. Furthermore, the study examines whether labour unions narrow down the gender-wage gap if it exists. This section presents the empirical regression results.

4.2.1. OLS and UQR results for the whole sample

Gender wage differential

In order to answer the question of whether a gender-wage gap exists in South Africa, the ordinary least squares (OLS) and unconditional quantile regression (UQR) models are estimated for the whole sample (both males and females) without an interaction term according to equation 1. The regression estimates are presented in table 2. Table 3 represents the regression estimates with an interaction term included in order to determine whether unions narrow down the gender-wage gap if it exists. The second column in table 2 and table 3 represents the estimates of the standard OLS model whilst the fourth up to the sixth column reports the UQR estimates for the 10th, 25th, 50th, 75th as well as the 90th percentiles respectively.

Table 3: OLS and Unconditional Quantile Regression results on the impact of gender and unions on wages for the whole sample

VARIABLES	(1) OLS	(2) Q10	(3) Q25	(4) Q50	(5) Q75	(6) Q90
INDIVIDUAL CHARACTERISTICS						
Tenure	0.0361*** (0.00752)	0.0247* (0.0140)	0.0526*** (0.0125)	0.0496*** (0.0118)	0.0232** (0.00933)	0.0312*** (0.0112)
Tenure Squared	-0.000557** (0.000220)	-0.000553 (0.000427)	-0.00127*** (0.000383)	-0.000907** (0.000361)	4.17e-05 (0.000285)	-0.000324 (0.000343)
Degree and Postgrad	0.636*** (0.0601)	0.204** (0.0976)	0.329*** (0.0875)	0.804*** (0.0825)	0.762*** (0.0651)	0.815*** (0.0783)
Provinces (excl. GP&WC)	-0.0584 (0.0492)	-0.155* (0.0816)	-0.0271 (0.0732)	-0.0431 (0.0690)	0.0413 (0.0545)	-0.0572 (0.0655)
Educated Mother	0.184*** (0.0466)	0.187** (0.0809)	0.208*** (0.0726)	0.264*** (0.0684)	0.0887 (0.0540)	0.0628 (0.0649)
Africans	-0.193*** (0.0609)	0.0364 (0.0960)	-0.113 (0.0861)	-0.286*** (0.0812)	-0.186*** (0.0640)	-0.203*** (0.0770)
Females	-0.197*** (0.0449)	-0.319*** (0.0779)	-0.222*** (0.0699)	-0.208*** (0.0658)	-0.213*** (0.0520)	-0.189*** (0.0625)
UNION STATUS						
No_Union	-0.319*** (0.0490)	-0.442*** (0.0850)	-0.592*** (0.0762)	-0.550*** (0.0719)	-0.0439 (0.0567)	0.0910 (0.0682)
OCCUPATION						
Managers	-0.214* (0.113)	-0.133 (0.592)	-0.251 (0.531)	-0.742 (0.501)	-0.709* (0.395)	0.309 (0.475)
Professionals	-0.392*** (0.0827)	-0.0527 (0.581)	-0.270 (0.521)	-0.794 (0.491)	-0.866** (0.388)	-0.189 (0.466)
Technicians & machine operators	-0.412*** (0.0917)	-0.0311 (0.588)	-0.0758 (0.527)	-1.031** (0.497)	-1.109*** (0.392)	-0.210 (0.472)
Clerks & elementary	-0.746*** (0.0796)	-0.417 (0.581)	-0.801 (0.522)	-1.287*** (0.492)	-1.233*** (0.388)	-0.286 (0.467)
Skilled Agriculture	-0.301 (0.561)	0.868 (1.088)	-0.465 (0.976)	-0.483 (0.920)	-0.539 (0.726)	-0.788 (0.873)
EMPLOYMENT DURATION						
Unspecified duration	-0.0701 (0.0807)	-0.0589 (0.141)	-0.0806 (0.127)	-0.0681 (0.119)	0.0574 (0.0943)	0.128 (0.113)
Permanent duration	0.401*** (0.0658)	0.574*** (0.117)	0.438*** (0.105)	0.441*** (0.0989)	0.288*** (0.0780)	0.280*** (0.0939)
INDUSTRY						
Agriculture	-0.194 (0.183)	0.573 (0.386)	-0.0786 (0.346)	-0.631* (0.326)	-0.424* (0.258)	-0.539* (0.310)
Mining & manufacturing	0.679*** (0.130)	1.601*** (0.317)	1.071*** (0.284)	0.462* (0.268)	0.136 (0.211)	0.118 (0.254)
Wholesale & Retail	0.162 (0.125)	1.319*** (0.315)	0.404 (0.283)	-0.174 (0.267)	-0.206 (0.210)	-0.313 (0.253)
Financial institutions	0.534*** (0.127)	1.932*** (0.316)	1.019*** (0.284)	0.196 (0.268)	-0.105 (0.211)	-0.0820 (0.254)
Public sector	0.403*** (0.126)	1.380*** (0.311)	1.074*** (0.279)	0.334 (0.263)	-0.206 (0.208)	-0.400 (0.250)
Constant	8.751*** (0.184)					
Observations	9,608	9,608	9,608	9,608	9,608	9,608
R-squared	0.527	0.117	0.264	0.395	0.450	0.328
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1, GP-Gauteng Province, WC –Western Cape Province

Both the OLS and UQR models in table 2 suggests that a gender-wage gap exists in South Africa. The QR estimates indicate that females earn significantly less than males across all the specified quantiles at 1%. According to the OLS model, females earn almost 20% less than males at the 1% level of significance. This is similar to the regression estimate from the 50th percentile (median) of the UQR model. Furthermore, contrary to Ntuli (2009a), the UQR model suggests that the gender-wage gap narrows down as we move higher up the income distribution. For instance, at the 10th percentile of the QR estimates, females earn about 32% less than males whilst at the 90th percentile, females earn about 19% less than males. This could be due to returns to education and other productive abilities being higher at the higher-end of the income distribution. For instance, Fiszbein, Giovagnoli, and Patrinos (2007), Martins and Pereira (2004) and Hartog, Pereira, and Vieira (2001) found that returns to education increase over the wage distribution. Furthermore, Hartog et al. (2001) highlights the interaction between schooling and ability, therefore leading to high-ability individuals benefiting more from their schooling and subsequently leading to the reduction in the gender-wage gap.

The existence of the gender-wage gap in South Africa can be explained by the taste-based discrimination theory by Becker (2010), which suggests that gender-wage differentials in favour of males could be due to an employer's preference towards male workers regardless of there being a female candidate who possess the same productive capacity as the male worker. An alternative theory to the taste-based theory is the statistical discrimination theory which implies that due to imperfect information about a worker's productive capacity, employers rely on an applicant's average characteristics (e.g. education and years of employment) when making hiring decisions. Considering that females may be forced to leave the labour force for some time or settle for lower levels of education (and consequently low-paying jobs) due to family responsibilities such as giving birth or taking care of sick family members, this puts male applicants at an advantage (even if they possess the same productive capabilities as female applicants) when competing for jobs due to the absence of career gaps for males.

Another theory that can explain this is the human capital theory by Polachek (1981) which implies that due to females being discouraged to obtain higher levels of education, they are deprived of opportunities to increase their skills and productivity in order to get high-paying and stable jobs. This forces them to settle for low-paying and unstable jobs. Furthermore, the labour market

segmentation theory explains that the females may be forced into “bad jobs” due to their low educational attainment compared to males and anticipated career breaks.

The summary statistics in Table 1 supports the segmented labour market theory since the majority of females in the sample are clerks, elementary workers, craftswomen as well as saleswomen (which can be viewed as “bad jobs” due to the low salaries they offer) as opposed to males who make up the majority of managers (which are viewed as “good jobs”). These occupations where females are the majority offer relatively lower salaries compared to managerial positions. Casale (2003), found that a high portion of women in South Africa occupy marginalized jobs. Colgan and Ledwith (2002, p. 209) also found the majority of women to be clerks and domestic workers in their South African study for 1999. Mosomi (2019) found a similar trend for South Africa. In the United States, Fichtenbaum (2006) found that more women occupied “bad jobs” compared to men, which is consistent with the segmented labour market theory.

The existence of a gender-wage gap in favour of males found in this study is consistent with South African literature by Butcher and Rouse (2001); Casale and Posel (2011); Kwenda and Ntuli (2018); Ntuli (2009b); Shepherd (2008). For European countries, Hedija (2017) also found a gender-wage gap to the disadvantage of females. In the United States, Blau and Kahn (1994); Card (2001a); Fichtenbaum (2006) found a gender wage gap in favour of males. Doiron and Riddell (1994); Mondal (2017) found the same for Canada and India respectively. Given the existence of the gender-wage gap in favour of males for South Africa, it is worthwhile to investigate the role of unions on income and whether unionisation narrows down the existing gender-wage gap.

Unionisation premium and moderation effects

The unionisation premium (or penalty) is captured by β_1 in equation 1 and the results are presented in table 2. Both the OLS and UQR results suggest that a union premium captured by β_2 in equations (1) and (2) exists in South Africa (i.e., workers who are not unionized earn significantly lower than those who are unionized). For instance, the OLS model suggests that workers who are not in unions earn about 32% less than those in unions. Similar to the OLS results, the median (50th) percentile of the UQR model suggest that the income for individuals who are not in unions is about 55% less than those in unions. Both these results are significant at 1%. This finding is consistent with South African studies by Butcher and Rouse (2001); Casale and Posel (2011); Hofmeyr and Lucas (2001); Ntuli (2009b); Schultz and Mwabu (1998). When it comes to international literature, a union wage premium has been confirmed in Germany, Denmark, Japan, the United Kingdom

(Sanner, 2006), India (Mondal, 2017), Canada (Doiron & Riddell, 1994; Freeman, 1980; Reilly, 1996; Sanner, 2006) as well as the United States (Freeman, 1980).

However, the union premium narrows down at higher ends of the income distribution. For instance, only results at the 10th, 25th and 50th percentiles are significant at 1% whilst the 75th and 90th percentiles are insignificant. In addition to that, UQR results from the 10th percentile suggest that people who are not in unions earn 44% less than those in unions whilst the 90th percentile suggest that people who are not in unions earn 9% more than those in unions. This finding suggests that unions have a positive impact on wages however, this impact gets weakened at higher ends of the income distribution. Bhorat, Naidoo, Oosthuizen, and Pillay (2016) also found a similar trend in their quantile regression analysis for South African data.

Union memberships is expected to have positive effects on wages since the role of unions is to promote equity in the labour market by advocating for higher and equitable salaries, individuals at the lower end of the income distribution are the biggest beneficiaries because unions try to push for their wage increases to improve their standard of living to match that of high income earners.

To answer the question of whether the existing gender-wage gap in South Africa narrows with unionisation, a model with an interaction term between the gender and union dummies (equation 2) is estimated. The estimates are presented in table 3.

Table 4: OLS and Unconditional Quantile Regression results on the impact of gender and unions on wages for the whole sample with interaction

VARIABLES	(1) OLS	(2) Q10	(3) Q25	(4) Q50	(5) Q75	(6) Q90
INDIVIDUAL CHARACTERISTICS						
Tenure	0.032*** (0.007)	0.027*** (0.010)	0.034*** (0.010)	0.037*** (0.008)	0.037*** (0.007)	0.045*** (0.014)
Tenure squared	-0.000** (0.000)	-0.000* (0.000)	-0.001** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001* (0.000)
Degree & Postgrad	0.680*** (0.053)	0.719*** (0.115)	0.677*** (0.066)	0.509*** (0.054)	0.567*** (0.059)	0.601*** (0.086)
Province (excl. GP&WC)	-0.109** (0.045)	-0.085 (0.058)	-0.093 (0.064)	-0.070 (0.058)	-0.147*** (0.048)	-0.123 (0.082)
Educated mother	0.213*** (0.045)	0.248*** (0.061)	0.217*** (0.058)	0.164*** (0.051)	0.156*** (0.041)	0.126** (0.049)
Africans	-0.289*** (0.051)	-0.013 (0.082)	-0.159** (0.073)	-0.295*** (0.055)	-0.403*** (0.061)	-0.619*** (0.103)
Females	-0.115** (0.054)	-0.199 (0.082)	-0.167 (0.067)	-0.131** (0.055)	-0.096*** (0.057)	-0.019*** (0.075)
UNION STATUS						
No_Union	-0.189*** (0.063)	-0.298*** (0.102)	-0.285*** (0.076)	-0.117 (0.081)	-0.134 (0.082)	-0.138 (0.090)
Females* No_Union	-0.208** (0.076)	-0.712*** (0.130)	-0.368*** (0.077)	-0.253** (0.088)	0.151 (0.096)	0.387 (0.116)
OCCUPATION						
Managers	0.043 (0.096)	-0.608** (0.281)	-0.457*** (0.160)	0.168 (0.140)	0.536*** (0.085)	0.711*** (0.205)
Professionals	-0.243*** (0.072)	-0.712*** (0.165)	-0.600*** (0.150)	-0.154* (0.092)	0.070 (0.077)	0.260 (0.177)
Technicians & machine operators	-0.238*** (0.086)	-0.702*** (0.215)	-0.640*** (0.141)	-0.305*** (0.100)	0.072 (0.089)	0.377 (0.240)
Clerks & elementary	-0.651*** (0.076)	-1.204*** (0.177)	-1.046*** (0.142)	-0.650*** (0.075)	-0.323*** (0.101)	-0.012 (0.220)
Skilled agriculture	-0.282 (0.527)	-0.599 (0.685)	-0.793 (0.752)	-1.066 (0.707)	0.314 (0.566)	-0.131 (0.801)
EMPLOYMENT DURATION						
Unspecified duration	-0.012 (0.078)	0.062 (0.109)	0.008 (0.113)	-0.014 (0.096)	-0.015 (0.106)	-0.050 (0.182)
Permanent	0.459*** (0.065)	0.559*** (0.086)	0.542*** (0.084)	0.501*** (0.068)	0.479*** (0.095)	0.267*** (0.098)
INDUSTRY						
Agriculture	-0.321* (0.177)	-0.791*** (0.193)	-0.678** (0.297)	-0.214 (0.280)	-0.119 (0.211)	0.531 (0.486)
Mining & manufacturing	0.735*** (0.110)	0.233* (0.133)	0.466*** (0.103)	0.759*** (0.162)	1.025*** (0.139)	1.482*** (0.199)
Retail	0.162 (0.105)	-0.232* (0.119)	0.022 (0.144)	0.148 (0.183)	0.239* (0.127)	0.728*** (0.202)
Finance	0.582*** (0.106)	0.099 (0.135)	0.386*** (0.124)	0.611*** (0.176)	0.716*** (0.124)	1.117*** (0.238)
Skilled agriculture	0.414*** (0.106)	-0.046 (0.116)	0.286** (0.126)	0.484*** (0.185)	0.656*** (0.134)	1.051*** (0.199)
Constant	8.653*** (0.167)	8.560*** (0.265)	8.656*** (0.230)	8.577*** (0.187)	8.664*** (0.253)	8.656*** (0.309)
Observations	9,608	9,608	9,608	9,608	9,608	9,608
R-squared	0.527	0.119	0.266	0.395	0.450	0.319
Time-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, GP-Gauteng Province, WC –Western Cape Province

The results still suggest that females generally earn less than males, but those who are not in unions earn less than males by a larger magnitude. This means that females who are not in unions face two types of wage differentials viz. a gender-wage differential and a union-wage differential. For instance, the 50th percentile of the UQR model suggests that females earn about 13% (β_2 in equations (1) and (2)) less than males but being a female who is not unionized further exacerbates the impact by 25% (captured by β_3 in equation 3). Therefore, females who are not unionized earn a total of 38% (13% + 25%) less than their male counterparts who are in unions.

Similarly, the OLS model suggests that females earn 11.5% less than males but being a female who is not unionized further exacerbates this impact by an additional 21%, thus implying that females who are not in unions earn 32.5% (11.5% + 21%) less than males. Similar to the results in table 2, the wage differential narrows down as we move higher up the income distribution. For instance, the UQR model suggests that at the 50th percentile, females earn 13.1% whilst at the 90th percentile, females earn only 1.9% less than males. A similar trend is observed when comparing females who are not in unions to males who are in unions. For instance, the 10th percentile of the UQR model in table 3 suggests that females who are not in unions earn about 71% less than males who are in unions. This differential in favour of males who are in unions reduces to about 25% at the 50th percentile. The wage differential for females who are not in unions compared to males who are in unions is significant only up to the 50th percentile. In the 75th and 90th percentiles the impact of unions is statistically insignificant. This suggests that unions may have less effect at the high level of the income distribution. Perhaps high income earners are able to negotiate for wages based on individual traits like better ability, talent and skills

Casale and Posel (2011, p. 41) also found that unions reduce the gender-wage gap in South Africa when controlling for age, marital status and whether the female is the head of the house. However, after controlling for the level of education, occupation, industry, firm size, whether a person is employed in the private or public sector and whether employment is part-time or permanent, Casale and Posel (2011) found that unions increase the gender-wage gap in favour of males. Casale and Posel (2011, p. 47) highlights that this could be due to the fact that “even though unionized women have a better set of productivity-related endowments than men, men are rewarded for these same endowments at a higher rate”.

Doiron and Riddell (1994) found that unions reduce the gender wage gap for Canada using methods that control for both the “explained” (i.e. arising from differences in characteristics of

males and females that affect unionisation) as well as the “unexplained” (i.e. arising from discrimination in the labour market) characteristics. Mondal (2017) found that the strength of unions in reducing the gender-wage gap has declined in India between 2004 – 2012 whilst Oberfichtner, Schnabel, and Töpfer (2020) on the other hand found no evidence of the impact of unionisation on the gender-wage gap in Germany using quantile regression. Perhaps endowments for males and females in Germany are the same.

All the control variables are significant and consistent with extant literature. For instance, consistent with South African studies by Butcher and Rouse (2001); Casale and Posel (2011); Hofmeyr and Lucas (2001); Kwenda and Ntuli (2018); Ntuli (2009b); Schultz and Mwabu (1998), both the OLS and UQR models suggest that there is a positive relationship between wages and tenure, postgraduate degrees as well as being permanently employed. In developed countries, Even and Macpherson (1993, p. 284); Kassenboehmer and Sinning (2014, p. 340). Given that unions reduce the gender-wage gap in South Africa, it is therefore worthwhile for policymakers to implement policies that encourage female participation in unions, especially since females are underrepresented in the union sector as suggested by the data in Table 1A.

4.2.2. OLS and UQR results for females

Seeing that females generally face wage discrimination in the workplace, the data is further segregated to one for females only for a better analysis. The results are presented in table 4.

Table 5: OLS and Unconditional Quantile Regression results on the impact of gender and unions on wages for females only

VARIABLES	(1) OLS	(2) Q10	(3) Q25	(4) Q50	(5) Q75	(6) Q90
INDIVIDUAL CHARACTERISTICS						
Tenure	0.0347*** (0.0100)	0.0331 (0.0213)	0.0496*** (0.0174)	0.0380** (0.0163)	0.0367*** (0.0123)	0.0257** (0.0123)
Tenure squared	-0.000557* (0.000287)	-0.000830 (0.000641)	-0.00120** (0.000525)	-0.000482 (0.000490)	-0.000246 (0.00037)	-4.40e-05 (0.000369)
Degree & Postgrad	0.578*** (0.0814)	0.114 (0.147)	0.275** (0.121)	0.883*** (0.113)	0.775*** (0.0853)	0.551*** (0.0849)
Province (excl. GP&WC)	-0.172*** (0.0596)	-0.278** (0.128)	-0.197* (0.105)	-0.223** (0.0978)	-0.0520 (0.0741)	-0.156** (0.0737)
Educated mother	0.129* (0.0661)	0.294** (0.125)	0.151 (0.103)	0.0827 (0.0958)	0.0501 (0.0726)	0.107 (0.0722)
Africans	-0.110 (0.0850)	0.181 (0.152)	-0.0210 (0.124)	-0.141 (0.116)	-0.160* (0.0878)	-0.170* (0.0873)
UNION STATUS						
No_Union	-0.456*** (0.0665)	-0.643*** (0.131)	-0.810*** (0.108)	-0.765*** (0.100)	-0.112 (0.0761)	0.111 (0.0757)
OCCUPATION						
Managers	0.0707 (0.183)	0.0131 (1.501)	-0.164 (1.229)	-1.033 (1.147)	0.607 (0.869)	0.567 (0.865)
Professionals	-0.240* (0.0625)	0.00525 (1.481)	-0.230 (1.213)	-1.085 (1.132)	0.492 (0.858)	-0.0901 (0.853)
Technicians & machine operators	-0.132 (0.111)	0.391 (1.496)	0.200 (1.226)	-0.803 (1.144)	0.122 (0.867)	-0.0793 (0.862)
Clerks & elementary	-0.625* (0.0734)	-0.470 (1.482)	-0.757 (1.214)	-1.571 (1.133)	0.113 (0.859)	-0.182 (0.854)
EMPLOYMENT STATUS						
Unspecified duration	-0.0797 (0.108)	-0.453** (0.215)	-0.0746 (0.176)	-0.109 (0.164)	0.0337 (0.124)	0.0528 (0.124)
Permanent	0.370* (0.0883)	0.403** (0.177)	0.509*** (0.145)	0.463*** (0.136)	0.230** (0.103)	0.102 (0.102)
INDUSTRY						
Agriculture	-0.0856 (0.148)	-1.003* (0.569)	0.181 (0.466)	-0.171 (0.435)	-0.0932 (0.330)	-0.0834 (0.328)
Mining & manufacturing	0.718*** (0.137)	0.900** (0.411)	1.298*** (0.337)	0.731** (0.314)	0.400* (0.238)	0.251 (0.237)
Wholesale & retail	0.139 (0.112)	1.230*** (0.385)	0.542* (0.315)	-0.0919 (0.294)	-0.128 (0.223)	-0.101 (0.222)
Financial institutions	0.579*** (0.127)	1.424*** (0.394)	1.393*** (0.323)	0.346 (0.301)	0.0697 (0.228)	0.120 (0.227)
Public sector	0.376*** (0.115)	0.880** (0.377)	1.047*** (0.309)	0.426 (0.289)	-0.0933 (0.219)	-0.0976 (0.217)
Constant	8.582*** (0.189)					
Observations	4,984	4,984	4,984	4,984	4,984	4,984
R-squared	0.567	0.123	0.244	0.392	0.504	0.381
Time-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, *p<0.1, GP-Gauteng Province, WC –Western Cape Province

The first column (1) of the results in table 4 represents the ordinary least squares (OLS) model and the second till the sixth column (2 till 6) represents the unconditional quantile regression (UQR) results. Similar to the results for the whole sample, both the OLS and UQR models for females suggests that females who are not unionized significantly earn lower than those who are unionized at 1% confidence level except the 75th and 90th percentiles of the UQR model (which are insignificant).

For instance, the 50th percentile of the UQR model suggests that females who are not in unions earn about 77% less than females in unions. The OLS model yields a similar trend by suggesting that females who are not unionized earn about 46% less than females who are unionized. The union wage gap narrows down at higher ends of the income distribution (i.e. the 75th and 90th percentiles), though the results are insignificant. The 75th percentile suggest that females who are in unions earn about 11.2% less than unionized females whilst the 90th percentile suggest that females who are not in unions earn about 11.1% more than females who are in unions. This finding is consistent with Casale (2003, p. 36) who found that females in unions earn at least twice as much as those who are not unionized. However, Lee (1978, p. 427) found that “the non-union sector pays females more than the union sectors”.

Similar to the whole sample, all control variables (apart from occupation control variables) are significant and consistent with extant literature. For instance, females who stay longer in a job the earn higher salaries. OLS underestimates this by suggesting that an additional year in a job increases female earnings by 2.9% whilst the 50th percentile in the UQR estimates suggest that one more year in a job increases female earnings by 3.7%. The results also suggest that education has a significant impact on wages across all significance levels. The mean percentile in the UQR estimates suggest that females who have degrees and/or postgraduates earn 44.1% higher than females who have qualifications lower than a degree whilst OLS overestimates this impact by suggesting that females who have a degree or postgraduate qualification earn about 65.7% higher than females who have qualifications below a degree.

Both OLS and UQR estimates suggest that females who reside in provinces outside Gauteng and the Western Cape earn lower wages. OLS overestimates this wage differential by suggesting that females residing outside Gauteng and the Western Cape earn 22.2% less than those who reside in the two aforementioned provinces whilst UQR estimates suggest that females residing outside of Gauteng and Western Cape earn only 13.2% lower. This wage differential is lower at higher ends

of the income distribution with wages of females who are non-residents of Gauteng and/or the Western Cape being 21.8% lower at the 10th percentile and only 7.9% lower at the 90th percentile. This 13.9% difference suggests that there are diminishing returns from enjoying higher salaries in Gauteng and/or the Western Cape. Females with educated mothers tend to earn higher salaries than those with uneducated mothers. OLS overestimates this by suggesting that females with educated mothers earn 15% higher than those with uneducated mothers whilst UQR suggests that females with educated mothers earn about 7.7% more than the latter.

Africans earn lower salaries than the other races, with the wage gap being higher and significant at higher levels of income. The mean percentile of the UQR estimates show that Africans earn 29.9% lower than other races whilst OLS underestimates this value by suggesting that Africans earn 20.7% lower than other races. The 10th percentile suggests a wage differential of 7.8% in favor of other races whilst the 90th percentile suggest that Africans earn 57.6% lower than other races. This suggests that Africans face more discrimination at higher ends of the income distribution.

Permanently employed females earn significantly higher than those in jobs that are not permanent. The UQR estimate suggests that at the 50th percentile, permanent females earn about 48.3% higher than females who aren't permanent whilst OLS underestimates the impact of being permanent by suggesting that permanent females earn about 42.2% higher than females who are not in permanent employment.

When looking at industries, mining and manufacturing, finance as well as skilled agriculture, females earn significantly higher than those in private households. OLS suggests that females in mining and manufacturing earn 75.2% higher than those in private households, in finance they earn 62.3% higher than those in private households and in skilled agriculture they earn 38.9% higher than those in private households. The 50th percentile of UQR suggests that females in mining and manufacturing earn 66.9% higher than those in private households. In retail, females earn higher than those in private households however, the results are insignificant except for the 90th percentile which suggests that females in that industry earn 69% higher than females in private households. Lastly, females in agriculture earn lower than females in private households across all percentiles though all the results are insignificant.

4.3. Coarsened Exact Matching

To ensure that results are robust to selection bias due to individuals self-selecting into jobs and union status, as well as likely heterogeneity and endogeneity, an alternative method of estimation, coarsened exact matching (CEM) is used. Casale and Posel (2011), Griliches (1977) highlights the possibility of selection bias and endogeneity when estimating income and returns to schooling models, which results in an upward bias of the beta estimates (Griliches, 1977, p. 12). It is also difficult to estimate the causal effect of returns to education on labour market outcomes (Card, 2001b). An ordinary least squares (OLS) and unconditional quantile (UQR) regressions are estimated on the matched sample.

Results for the CEM model for the whole sample are presented in Table 5. Table 7 in the Appendix represents the results with an interaction between union and gender. The CEM results are consistent with the unconditional quantile regression results. CEM results suggest that females earn significantly less than males across all quantiles. This gender-wage gap narrows down at higher ends of the income distribution. For instance, the 10th and 50th quantiles suggest that females earn 33.3% and 28.4% less than their male counterparts respectively. This wage gap narrows down to females earning 18.6% and 19.1% less than males at the 75th and 90th quantiles respectively. The CEM results with interaction in Table 7 suggest that females earn significantly lower than males only at higher-ends of the income distribution. This implies that gender-wage discrimination only exists at higher-ends of the income distribution.

Furthermore, the CEM results suggest that individuals who are not in unions earn significantly less than individuals who are in unions only at lower quantiles (i.e. the 10th, 25th and 50th quantiles). A similar trend is observed in the UQR results and CEM results with interaction. Similar to the UQR results with interaction, the CEM results with interaction in Table 7 suggest that females who are not in unions earn significantly less than females who are in unions only for the 10th, 25th and 50th quantiles. This finding implies that unions only have an impact on wages for low-income earners but as we move higher up the income distribution, the impact disappears.

Table 6: Coarsened Exact Matching results on the impact of gender and unions on wages for the whole sample

VARIABLES	(1) OLS	(2) Q10	(3) Q25	(4) Q50	(5) Q75	(6) Q90
INDIVIDUAL CHARACTERISTICS						
Tenure	0.029*** (0.009)	0.032 (0.021)	0.040*** (0.013)	0.062*** (0.017)	0.018 (0.012)	-0.002 (0.013)
Tenure squared	-0.000 (0.000)	-0.001 (0.001)	-0.001** (0.000)	-0.001** (0.001)	0.001* (0.000)	0.001*** (0.000)
Degree & Postgrad	0.589*** (0.067)	0.060 (0.151)	0.141 (0.099)	0.795*** (0.124)	0.794*** (0.089)	0.702*** (0.093)
Province (excl. GP&WC)	-0.068 (0.047)	-0.265** (0.105)	-0.041 (0.068)	-0.086 (0.086)	-0.004 (0.062)	-0.064 (0.065)
Educated Mother	0.145*** (0.047)	0.225** (0.105)	0.179*** (0.069)	0.237*** (0.086)	0.083 (0.062)	0.094 (0.065)
Africans	-0.176*** (0.058)	0.071 (0.130)	-0.148* (0.085)	-0.199* (0.106)	-0.187** (0.076)	-0.081 (0.080)
Females	-0.180*** (0.046)	-0.333*** (0.104)	-0.218*** (0.068)	-0.284*** (0.085)	-0.186*** (0.061)	-0.191*** (0.064)
UNION STATUS						
No_Union	-0.366*** (0.056)	-0.521*** (0.125)	-0.612*** (0.082)	-0.647*** (0.103)	-0.020 (0.074)	0.088 (0.077)
OCCUPATION						
Managers	-0.311*** (0.089)	-0.283 (0.201)	-0.244* (0.131)	-0.123 (0.165)	-0.001 (0.118)	-0.454*** (0.124)
Professionals	-0.215** (0.098)	-0.203 (0.220)	-0.013 (0.144)	-0.017 (0.180)	-0.357*** (0.129)	-0.284** (0.136)
Technicians & machine operators	-0.663*** (0.078)	-0.730*** (0.176)	-0.645*** (0.115)	-0.630*** (0.144)	-0.472*** (0.104)	-0.527*** (0.109)
EMPLOYMENT STATUS						
Unspecified duration	-0.030 (0.074)	-0.087 (0.168)	-0.156 (0.110)	-0.140 (0.137)	0.046 (0.099)	0.056 (0.103)
Permanent	0.381*** (0.063)	0.441*** (0.142)	0.302*** (0.093)	0.537*** (0.116)	0.264*** (0.084)	0.197** (0.088)
INDUSTRY						
Agriculture	0.009 (0.177)	-0.406 (0.397)	0.634** (0.260)	-0.234 (0.325)	-0.320 (0.234)	-0.388 (0.245)
Mining & manufacturing	0.719*** (0.138)	1.684*** (0.311)	1.288*** (0.203)	0.436* (0.254)	0.147 (0.183)	-0.022 (0.192)
Retail	0.273** (0.135)	1.670*** (0.303)	0.808*** (0.198)	-0.180 (0.248)	-0.214 (0.179)	-0.310* (0.187)
Finance	0.632*** (0.137)	2.161*** (0.308)	1.458*** (0.202)	0.173 (0.253)	-0.106 (0.182)	-0.201 (0.190)
Skilled agriculture	0.527*** (0.134)	1.518*** (0.301)	1.237*** (0.196)	0.545** (0.246)	-0.197 (0.177)	-0.344* (0.186)
Constant	8.625*** (0.183)	6.477*** (0.413)	7.479*** (0.270)	8.692*** (0.338)	9.723*** (0.243)	10.387*** (0.255)
N	5,366	5,366	5,366	5,366	5,366	5,366
R ²	0.53	0.23	0.38	0.46	0.34	0.21
Time-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, *p<0.1, GP-Gauteng Province, WC –Western Cape Province

4.4. Additional analysis

In order to draw parallels with other studies, additional analysis using different proxies of income is conducted for the equivalent of the model for the whole sample, i.e., table 3 & 4. Income is proxied using average hourly wages and real wage equivalents. The results from additional analysis are qualitatively similar to the ones found earlier. Firstly, the study finds that there is a gender-wage gap in favour of males in South Africa. However, this gender-wage gap narrows down as we move higher up the income distribution. Secondly, unions have a positive (negative) impact on wages (gender wage-gap), however the impact diminishes as we move higher on the income distribution (see, table 8 & 9 in the appendix) suggesting that unions mostly benefit low-income earners. All other control variables are significant and similar to the ones found earlier.

5. Conclusion and policy recommendations

Wage inequality is arguably one of the most important concepts in a country with social ills like South Africa. Labour unions are actively advocating for higher wages and gender equality. This study uses more recent econometric techniques, unconditional quantile regression (UQR) and coarsened exact matching (CEM) with interaction effects to investigate the existence of a gender-wage gap in South Africa and whether labour unions reduce the gender-wage gap if it exists. The interaction helps flesh out the moderating role of being a union member on the gender-wage gap. Furthermore, this study uses a different dataset, the National Income Dynamics Study (NIDS) from the ones used in the extant literature on unions and the gender-wage gap in South Africa. The data from both models suggests evidence of a gender-wage gap in South Africa, though narrowing at higher-ends of the income distribution. Perhaps this is due to individuals with higher productive abilities having higher returns to schooling (Martins & Pereira, 2004).

Both the CEM and UQR results also suggest a strong positive relationship between labour unions and wages. Furthermore, both models suggest that labour unions narrow down the gender-wage gap in South Africa. However, the impact of labour unions seem to be weakened at higher-ends of the income distribution as the magnitude in which the gender-wage gap narrows down at higher-ends of the income distribution. A possible explanation to this could be that high-income earners are individuals with high productive abilities and high education levels, which increases their bargaining power and signals their abilities to employers thus leading to employers being able to determine an estimate of the wages they deserve and subsequently leading to a lower gender-wage

gap. The historic hindrances in women obtaining higher levels of education and career opportunities in South Africa is another possible explanation to this.

These findings are important as they indicate that either the bargaining power of unions is weakened at higher ends of the income distribution, or gender-wage inequality is lower for high-income earners. It is worthwhile for policymakers to bear in mind of this dynamic before implementing “one-for-all” union policies. Furthermore, considering that unions benefit low-income earners, the government could impose a requirement for companies to encourage a specific percentage of their low-earning employees to join unions. This would empower the low-income earners who don’t have as much bargaining power as high-income earners.

To the best of our knowledge, South African literature on the role of unions in addressing the gender-wage gap is rather scarce. An area that hasn’t been widely explored is the role of unions in addressing gender-wage inequality. In South Africa, only this study and that of Casale and Posel (2011) have studied the effects of unions on gender-wage inequality. More studies testing different analytical methods and datasets are needed in this area of study.

In conclusion, it should be noted that this is a single country study, which therefore limits our ability to draw generalizations. In addition, this study employs methods of analysis that have not widely been researched in the literature (i.e. unconditional quantile regression and coarsened exact matching), which makes it difficult to draw generalizations and compare the results of this study to existing ones. Furthermore, CEM and UQR techniques have not been widely used for studies on the effects of unions on wages. Therefore, there are few studies to compare the current one with. In future as the techniques become more popular, it will be easier to compare and add to the literature.

The policy implications from this study are that; (1) policy-makers need to reinforce initiatives and policies that are geared towards empowering the bargaining power of low income earners through bargaining councils or unions; (2) policies aimed towards addressing gender inequality at the workplace need to be strengthened considering that women still face wage discrimination.

6. References

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7. Appendix

Table 7: Variable definitions and references

Variable Names	Variable Description	NIDS Questionnaire Reference
Dependent Variable		
Y_i	The log of the gross monthly income	Wave 1: E8, Waves 2&3: E10, Wave 4: Eb9, Wave 5: Eb22
Main Research Variables		
NO_UNION	Unionisation dummy (equal to one if individual does not belong to a union and zero otherwise).	Wave 1: E14, Wave 2&3: E16, Wave 4&5: Eb15
FEMALE	Gender dummy, assuming a value of 1 if female and zero otherwise	Question B2 in all the 5 waves
Individual Characteristics (Covariates)		
Tenure	Number of years an individual has been working in the current job.	Wave 1: E2, Waves 2&3: E3, Waves 4&5: Eb2
Tenure Squared	The square of the number of years an individual has been working in the current job.	Wave 1: E2, Waves 2&3: E3, Waves 4&5: Eb2
Province	A dummy variable representing an individual's province of residence at the time of the survey. It is equal to 0 if an individual resided in Gauteng or Western Cape and 1 otherwise.	Wave 1: B14, Waves 2 to 5: B13
African (Population group dummy)	A dummy variable representing an individual's population group. It assumes the value of 1 if African and zero if White, Asian/Indian or Coloured	Question B3 in all the 5 waves
Mother's Education	A dummy variable representing the highest level of education for an individual's mother. It assumes a value of 0 for mothers with no schooling and 1 otherwise	Wave 1: D8, Waves 2 to 5: D8b
Education	Individuals who have university degrees and postgraduate degrees.	Wave 1 to 4: H8, Wave 5: H9
Job Characteristics (Covariates)		
Industry	An indicator variable representing an individual's industry of work. Private household industry jobs are the reference group.	Wave 1: E7, Wave 2&3: E9, Wave 4&5: Eb8
Occupation	An indicator variable representing jobs that require advanced training and education. Armed forces are the reference group.	Wave 1: E4, Wave 2&3: E6, Wave 4&5: Eb5
Permanent	An indicator variable representing an individual's employment duration. Limited duration of employment is the reference group.	Wave 1: E13.2, Wave 2&3: E15.2, Waves 4&5: E14.3

Table 8: Coarsened Exact Matching results on the impact of gender and unions on wages for the whole sample (with interaction)

VARIABLES	(1) OLS	(2) Q10	(3) Q25	(4) Q50	(5) Q75	(6) Q90
INDIVIDUAL CHARACTERISTICS						
Tenure	0.026*** (0.009)	0.025 (0.020)	0.036*** (0.013)	0.057*** (0.017)	0.019 (0.012)	-0.001 (0.013)
Tenure squared	-0.000 (0.000)	-0.001 (0.001)	-0.001** (0.000)	-0.001* (0.001)	0.001* (0.000)	0.001*** (0.000)
Degree & Postgrad	0.591*** (0.067)	0.066 (0.150)	0.145 (0.098)	0.799*** (0.123)	0.794*** (0.089)	0.700*** (0.093)
Province (excl. GP&WC)	-0.062 (0.046)	-0.250** (0.104)	-0.032 (0.068)	-0.076 (0.085)	-0.005 (0.062)	-0.068 (0.065)
Educated Mother	0.139*** (0.046)	0.211** (0.104)	0.171** (0.068)	0.228*** (0.086)	0.085 (0.062)	0.098 (0.065)
Africans	-0.178*** (0.057)	0.064 (0.129)	-0.151* (0.084)	-0.203* (0.106)	-0.187** (0.076)	-0.079 (0.080)
Females	-0.033 (0.061)	0.062 (0.138)	0.008 (0.090)	-0.036 (0.113)	-0.218*** (0.082)	-0.295*** (0.086)
UNION STATUS						
No_Union	-0.181** (0.075)	-0.026 (0.169)	-0.329*** (0.111)	-0.336** (0.139)	-0.060 (0.100)	-0.042 (0.105)
Females*No_Union	-0.315*** (0.087)	-0.845*** (0.196)	-0.483*** (0.128)	-0.529*** (0.161)	0.067 (0.116)	0.223* (0.122)
OCCUPATION						
Managers	-0.315*** (0.089)	-0.293 (0.200)	-0.250* (0.131)	-0.129 (0.164)	0.000 (0.118)	-0.452*** (0.124)
Professionals	-0.173* (0.098)	-0.092 (0.220)	0.051 (0.144)	0.053 (0.180)	-0.366*** (0.130)	-0.314** (0.137)
Technicians & machine operators	-0.626*** (0.078)	-0.630*** (0.176)	-0.588*** (0.115)	-0.568*** (0.145)	-0.480*** (0.104)	-0.553*** (0.109)
EMPLOYMENT STATUS						
Unspecified duration	-0.031 (0.074)	-0.089 (0.166)	-0.157 (0.109)	-0.141 (0.137)	0.046 (0.099)	0.056 (0.103)
Permanent	0.382*** (0.063)	0.446*** (0.141)	0.304*** (0.092)	0.540*** (0.116)	0.263*** (0.084)	0.195** (0.088)
INDUSTRY						
Agriculture	-0.030 (0.176)	-0.511 (0.395)	0.575** (0.259)	-0.299 (0.324)	-0.311 (0.234)	-0.360 (0.245)
Mining & manufacturing	0.686*** (0.138)	1.594*** (0.309)	1.237*** (0.202)	0.380 (0.254)	0.154 (0.183)	0.001 (0.192)
Retail	0.249* (0.134)	1.606*** (0.301)	0.772*** (0.197)	-0.220 (0.248)	-0.208 (0.179)	-0.293 (0.187)
Finance	0.590*** (0.137)	2.050*** (0.307)	1.395*** (0.201)	0.103 (0.252)	-0.097 (0.182)	-0.171 (0.191)
Skilled agriculture	0.515*** (0.133)	1.485*** (0.298)	1.219*** (0.195)	0.524** (0.245)	-0.195 (0.177)	-0.335* (0.185)
constant	8.562*** (0.183)	6.310*** (0.411)	7.384*** (0.269)	8.587*** (0.338)	9.737*** (0.244)	10.431*** (0.256)
Observations	4,366	4,366	4,366	4,366	4,366	4,366
R-squared	0.54	0.24	0.39	0.46	0.35	0.21
Time-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, *p<0.1, GP-Gauteng Province, WC-Western Cape Province

Table 9: OLS&QR Estimates with interaction for the whole sample using real hourly wages

VARIABLES	(1) Q1	(2) Q10	(3) Q25	(4) Q50	(5) Q75	(6) Q90
INDIVIDUAL CHARACTERISTICS						
Tenure	0.038*** (0.009)	0.020 (0.016)	0.052*** (0.013)	0.059*** (0.013)	0.035*** (0.011)	0.024* (0.014)
Tenure squared	-0.001** (0.000)	-0.000 (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.000 (0.000)	-0.000 (0.000)
Degree & Postgrad	0.617*** (0.068)	0.185* (0.109)	0.312*** (0.093)	0.654*** (0.090)	0.822*** (0.080)	0.768*** (0.097)
Province (excl. GP&WC)	-0.047 (0.059)	-0.138 (0.091)	-0.044 (0.078)	-0.101 (0.075)	-0.017 (0.067)	-0.002 (0.081)
Educated Mother	0.188*** (0.053)	0.085 (0.091)	0.321*** (0.078)	0.256*** (0.075)	0.116* (0.067)	0.074 (0.081)
Africans	-0.124* (0.069)	0.115 (0.107)	0.019 (0.091)	-0.128 (0.088)	-0.052 (0.078)	-0.062 (0.095)
Females	-0.121** (0.054)	0.035 (0.117)	0.015 (0.100)	-0.004 (0.097)	-0.258*** (0.086)	-0.122 (0.104)
UNION STATUS						
No_Union	-0.284*** (0.057)	-0.028 (0.131)	-0.310*** (0.112)	-0.366*** (0.108)	-0.169* (0.096)	0.045 (0.116)
Females*No_Union	-0.298** (0.149)	-0.545*** (0.163)	-0.286** (0.139)	-0.277** (0.134)	0.186 (0.119)	0.016 (0.144)
OCCUPATION						
Managers	-0.152 (0.159)	0.086 (0.665)	-0.193 (0.568)	-0.744 (0.549)	0.683 (0.486)	0.244 (0.588)
Professionals	-0.286** (0.139)	-0.003 (0.652)	-0.221 (0.557)	-0.828 (0.539)	0.574 (0.476)	-0.287 (0.577)
Technicians & machine operators	-0.376*** (0.146)	0.097 (0.660)	-0.049 (0.564)	-0.973* (0.545)	0.167 (0.482)	-0.417 (0.584)
Clerks & elementary	-0.724*** (0.139)	-0.430 (0.653)	-0.817 (0.558)	-1.367** (0.539)	0.084 (0.477)	-0.380 (0.578)
Skilled Agriculture	-0.255 (0.584)	0.796 (1.220)	-0.448 (1.043)	-0.427 (1.008)	1.146 (0.892)	-0.858 (1.080)
EMPLOYMENT STATUS						
Unspecified duration	-0.051 (0.094)	-0.098 (0.160)	-0.224 (0.137)	0.070 (0.132)	0.063 (0.117)	0.036 (0.142)
Permanent	0.312*** (0.076)	0.492*** (0.133)	0.275** (0.113)	0.468*** (0.110)	0.201** (0.097)	0.206* (0.117)
INDUSTRY						
Agriculture	-0.412* (0.231)	-0.350 (0.451)	-0.900** (0.386)	-0.652* (0.373)	-0.182 (0.330)	-0.134 (0.399)
Mining & manufacturing	0.427** (0.188)	0.536 (0.374)	0.636** (0.319)	0.290 (0.309)	0.293 (0.273)	0.379 (0.331)
Retail	-0.108 (0.184)	0.179 (0.372)	-0.279 (0.318)	-0.368 (0.307)	0.048 (0.272)	0.033 (0.329)
Finance	0.216 (0.188)	0.818** (0.373)	0.298 (0.319)	0.054 (0.308)	0.120 (0.273)	0.221 (0.330)
Skilled agriculture	0.235 (0.182)	0.497 (0.367)	0.609* (0.314)	0.285 (0.303)	-0.003 (0.268)	0.014 (0.325)
Constant	6.577*** (0.261)	4.678*** (0.779)	5.488*** (0.666)	7.090*** (0.644)	6.564*** (0.569)	7.639*** (0.689)
R ²	0.38	0.15	0.33	0.37	0.28	0.12
N	4,366	4,366	4,366	4,366	4,366	4,366
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, *p<0.1, GP-Gauteng Province, WC-Western Cape Province

Table 10: OLS&QR Estimates with interaction for the whole sample using nominal hourly wages

VARIABLES	(1) Q1	(2) Q10	(3) Q25	(4) Q50	(5) Q75	(6) Q90
INDIVIDUAL CHARACTERISTICS						
Tenure	0.045*** (0.008)	0.016 (0.015)	0.059*** (0.014)	0.055*** (0.012)	0.034*** (0.011)	0.028** (0.014)
Tenure squared	-0.001*** (0.000)	-0.000 (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.000 (0.000)	-0.000 (0.000)
Degree & Postgrad	0.613*** (0.066)	0.202* (0.104)	0.329*** (0.094)	0.677*** (0.084)	0.878*** (0.078)	0.843*** (0.097)
Province (excl. GP&WC)	-0.052 (0.054)	-0.162* (0.088)	-0.062 (0.079)	-0.079 (0.070)	0.036 (0.065)	0.025 (0.081)
Educated Mother	0.207*** (0.052)	0.098 (0.087)	0.311*** (0.079)	0.251*** (0.070)	0.100 (0.065)	0.070 (0.081)
Africans	-0.168** (0.065)	0.072 (0.103)	-0.045 (0.093)	-0.288*** (0.082)	-0.020 (0.076)	-0.099 (0.095)
Females	-0.064 (0.067)	0.068 (0.112)	-0.018 (0.101)	-0.029 (0.090)	-0.251*** (0.083)	-0.127 (0.104)
UNION STATUS						
No_Union	-0.284*** (0.057)	-0.028 (0.131)	-0.310*** (0.112)	-0.366*** (0.108)	-0.169* (0.096)	0.045 (0.116)
Females*No_Union	-0.160* (0.093)	-0.574*** (0.155)	-0.287** (0.140)	-0.221* (0.124)	0.191* (0.116)	0.077 (0.144)
OCCUPATION						
Managers	-0.068 (0.135)	0.015 (0.633)	-0.125 (0.571)	-0.125 (0.507)	0.711 (0.471)	0.155 (0.588)
Professionals	-0.212** (0.107)	-0.014 (0.621)	-0.209 (0.561)	-0.246 (0.497)	0.573 (0.462)	-0.326 (0.577)
Technicians & machine operators	-0.298** (0.117)	0.101 (0.629)	-0.000 (0.567)	-0.425 (0.503)	0.139 (0.468)	-0.451 (0.584)
Clerks & elementary	-0.632*** (0.107)	-0.392 (0.622)	-0.800 (0.561)	-0.790 (0.498)	0.084 (0.463)	-0.430 (0.577)
Skilled Agriculture	-0.199 (0.570)	0.731 (1.162)	-0.480 (1.049)	-0.026 (0.931)	1.086 (0.865)	-0.934 (1.079)
EMPLOYMENT STATUS						
Unspecified duration	-0.081 (0.091)	-0.090 (0.153)	-0.326** (0.138)	-0.016 (0.122)	0.060 (0.114)	0.034 (0.142)
Permanent	0.289*** (0.074)	0.478*** (0.127)	0.255** (0.115)	0.331*** (0.102)	0.245*** (0.094)	0.187 (0.118)
INDUSTRY						
Agriculture	-0.479** (0.236)	-0.352 (0.430)	-0.885** (0.388)	-0.570* (0.344)	-0.296 (0.320)	-0.117 (0.399)
Mining & manufacturing	0.388** (0.192)	0.562 (0.356)	0.558* (0.321)	0.262 (0.285)	0.151 (0.265)	0.453 (0.331)
Retail	-0.160 (0.188)	0.129 (0.354)	-0.391 (0.320)	-0.338 (0.284)	-0.118 (0.264)	0.049 (0.329)
Finance	0.202 (0.191)	0.795** (0.356)	0.228 (0.321)	0.035 (0.285)	-0.049 (0.265)	0.208 (0.330)
Skilled agriculture	0.202 (0.187)	0.459 (0.350)	0.617* (0.316)	0.204 (0.280)	-0.155 (0.260)	-0.033 (0.325)
_cons	3.703*** (0.247)	1.986*** (0.743)	2.775*** (0.670)	4.008*** (0.595)	3.804*** (0.552)	4.888*** (0.689)
R ²	0.42	0.16	0.36	0.38	0.29	0.13
N	4,366	4,366	4,366	4,366	4,366	4,366
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, *p<0.1, GP-Gauteng Province, WC-Western Cape Province