LABOUR PRODUCTIVITY AND EMPLOYEE DIVERSITY IN THE SOUTH AFRICAN WORKPLACE

Hardus van Zyl
University of Johannesburg
hardusvz@uj.ac.za

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Abstract

The aim of this article is to determine the impact that employee diversity attributes have on labour productivity in the South African workplace. Given the perceived general low levels of labour productivity in the South African economy, this particular research aims to serve as a further contribution to our understanding of the labour productivity debate when a broad range of employee attributes at firm and individual levels are considered. A firm-based model is used for the estimation of the link between the employee group demographic characteristics and labour productivity, and an employee remuneration model is used to estimate the link between individual employee diversity demographics and labour productivity. The main conclusions of the estimation results are that a less age-diverse workforce, higher education/training levels, greater levels of gender diversity and a more racially diverse workforce are pre-requisites for higher real remuneration and labour productivity benefits.

Keywords

Employee attributes, workforce diversity, productivity; labour productivity, firm-based model, employee remuneration model

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Prof G van Zyl is a professor in the Department of Economics and Econometrics, University of Johannesburg, South Africa.

1. INTRODUCTION

The aim of this article is to determine the impact that employee diversity attributes have on labour productivity in the South African workplace. The manufacturing industry of the Gauteng Province of South Africa is used as a case study. Employee diversity attributes in this regard comprise age, training/education, gender and race. The results are used in two ways: i) to determine the impact of the employee diversity attributes on labour productivity at firm level and ii) to determine the labour productivity impact of employee diversity attributes at the individual employee level.

As is the case with modern economies around the world, the South African workplace is also generally viewed as diversified when employee attributes such as age differences, different education and training levels, gender participation rates and the racial composition are considered. Given the perceived general low levels of labour productivity in the South African economy this particular research aims to serve as a further contribution to our understanding of the labour productivity debate when a broad range of employee attributes at firm and individual levels are considered. Labour econometric estimations in this regard have been conducted for developed economies, but no similar estimation results have been published for developing economies, where the dynamics of the workforce are different. Limited research in the South African labour economic field has been conducted on the link between employee diversity in the South African workplace and labour productivity. Labour economic estimation results for the South African workforce have been published on the labour productivity impact of some aspects of labour diversity such as age and skill levels (Van Zyl, 2013) and education and training levels (Van Zyl, 2013). In these two studies the research on the impact of age, skill levels and education and training on labour productivity was not viewed in the context of employee diversity per se. Given the diversity of the South African labour force and the on-going debate on the low levels of labour productivity, it is deemed necessary to estimate the impact that employee diversity attributes might have on labour productivity.

2. LITERATURE REVIEW

Human Resource Management (HRM) studies on employee diversity issues are numerous, most often either case-study-based or special-data-based, and the research results on the link between the various employee diversity attributes and labour productivity are mixed given the fact that the focus of HRM studies on employee diversity attributes in the main takes two forms (Riordan, 2000; Jackson, Joshi & Erhardt, 2003; Choi, 2007; Harrison & Klein, 2007; Horwiz & Horwiz, 2007; Roberge & Van Dick, 2010; Kurtulus, 2011; Kurtulus, 2012). Firstly, the impact of group dynamics and the effect that they have on the composition of employee groups have been widely researched and most of these studies analysed the effect of employee group composition in the context of relational demographics and group diversity. Research findings in this regard are: i) that the organisational performance of a firm can be enhanced by a homogeneous labour force that is characterised by great similarities (Riordan, 2000), ii) that higher levels of competition among employees should create positive productivity spill-over effects (Choi, 2007) and iii) that labour productivity can be improved when high levels of age similarity exist (Jackson et al., 2003). Secondly, the impact that demographic attributes will have on employee performance in the workplace are well researched in the HRM literature (Harrison & Klein, 2007; Kurtulus, 2011; Kurtulus, 2012). These demographic attributes are either task-related attributes

that deal with required skill levels in the workplace or relational attributes that would normally deal with interpersonal employee relationships in the workplace. All the above-mentioned studies indicate that the numerous diversity concepts (such as age, race, gender, training/educational levels and skill levels) require different measures such as typology measurements, standard deviations, various dissimilarity measures and measurable outcome variables.

From a labour economic viewpoint the problem with the HRM studies is that the data sets are typically small and are not really representative of all firms or employees in a specific industry (Hellerstein & Neumark, 2004; Ilmakunnas, Maliranta & Vainiomaki, 2004; Parrotta, Pozzoli & Pytlikova, 2012). Most of the labour economic research on the impact of employee diversity on productivity uses large representative data sets. Econometric estimations either utilise larger linked employee-employer data sets or large time-series from sample firms (Hamilton, Nickerson & Owan, 2004; Alesina & La Ferrara, 2005; Heyman, 2005; Ilmakunnas & Maliranta, 2005; Grund & Westergard-Nielsen, 2008; Iranzo, Schivardi & Tosetti, 2008; Mas & Moretti, 2009; Ilmakunnas & Ilmakunnas, 2011; Garnero & Rycx, 2013). All of these studies are based on the premise that the effect of employee diversity will reflect in individual employee wages. The argument is that a positive impact of employee diversity attributes on productivity will have a positive impact on individual employee wages. Some aspects of the main findings of the different labour economic studies in this regard are summarised in the next few paragraphs.

Alesina et al. (2005) conclude that the share of employees with similar diversity attributes could have either a positive or negative impact on labour productivity. The authors indicate that once employees with similar attributes (be it gender, race, age or education) are in the minority the impact on labour productivity will be negative and that a positive impact on labour productivity is only possible if all the employees regard diversity attributes as a 'common good' in the workplace. Kremer (1993) and Weis (2007) are of the opinion that employee diversity does not create labour productivity benefits for the firm but those employees with similar age and skills in the workplace do create positive labour productivity effects. Roberge et al. (2010), Hoogendoorn, Oosterbeek and Van Praag (2011), Vandenberghe (2011), Haile (2012) and Garnero et al. (2013) indicate that the level of gender diversity and the existence of wage-gaps have a profound impact on labour productivity. These studies indicate i) higher levels of labour productivity for workplaces characterised by higher skill levels and greater levels of gender diversity, ii) lower levels of labour productivity when females migrate to lower skill occupations and iii) lower labour productivity levels for females when negative wage-gaps (males receiving a greater remuneration for the same work than females) exist.

The studies by Hamilton et al. (2004) and Ilmakunnas et al. (2011) indicate a possible negative relationship between educational diversity and productivity. The authors argue that the spread of education and training levels can become too wide in the workforce, thus limiting the positive labour productivity spill-over effects that employees with higher levels of education and training can generate. The complementarity of different skills and other diversity attributes is important. In this regard Mas et al. (2009) indicate that i) provided that the condition of complementarity is met, a diversified workforce should contribute to positive labour productivity levels, and ii) that when employees with different productivity levels are put together in the same work environment peer pressure should enhance positive labour productivity levels.

The limited availability of productivity measures on an individual employee level exacerbates the difficulty of estimating the impact of employee diversity on productivity (Ilmakunnas et al.,

2004). The use of both employer-employee data sets and firm-base data series makes it easier i) to measure the employee diversity attributes in firms and industries (Ilmakunnas et al., 2005), ii) to combine employee characteristics for the purpose of measuring multidimensional employee diversity attributes (Barrington et al., 2001) and iii) to link employee remuneration profiles to employee diversity attributes (Parrotta et al., 2002). Employee remuneration dispersion (measured by the variance of employee remuneration) is viewed as an indicator for employee diversity attributes (Winter-Ebmer & Zweimuller, 1999 and Heyman, 2005).

There is a lack of labour economic research on a more disaggregated level within individual firms in this regard (Weis, 2007). Ilmakunnas et al. (2011) developed a combined analysis that is a representative employee-employer data set combined with alternative employee diversity attributes measurement at the individual firm level. The authors developed two models that would facilitate a comprehensive analysis of the impact of employee diversity on labour productivity. Firstly, a firm-based model is used for the estimation of the link between the employee group demographic characteristics and labour productivity, and secondly an employee remuneration model is used to estimate the link between individual employee diversity demographics and labour productivity. The argument for using an employee remuneration model is based on the assumption that employee diversity impacts on labour productivity and should thus have an impact on employee remuneration. The employee diversity attributes included in the Ilmakunnas et al. (2011) models are age, education and training and gender. The validity and the reliability of the Ilmakunnas et al. (2011) estimation models have been established in an extensive study on the impact of employee diversity on labour productivity in the Finnish economy. For the purpose of this study an adapted and simplified version of the Ilmakunnas et al. (2011) estimation models is used because the workforce dynamics of a developing economy such as South Africa's differ from those of a developed economy (the Finnish economy). In the Ilmakunnas et al. (2011) model the race attributes of the workforce was not included. In the adapted model they are included because the impact of the race attribute of the South African workforce is of great importance.

3. RESEARCH DESIGN

3.1 Research approach and method

The research design comprises the

- identification of the categories of employee diversity attributes that will be included in the estimation models,
- specification of the two estimation models that would capture the impact of employee diversity attributes on labour productivity in the workplace,
- compilation of an employer-employee data set for a proxy group of firms, statistical validation of the required sample of firms and the diversity data collected in the proxy industry,
- estimation and computation process and
- interpretation of the estimation and computation results.

3.2 Model specification

The methodology of the two adapted and simplified models of Ilmakunnus et al. (2011: 233-237), as it is applied in this particular study, is explained in the following few paragraphs. In order to determine the holistic impact of the different employee diversity attributes on labour productivity both firm-based and individual employee relational characteristics are taken into consideration.

For the firm-based productivity model the logarithm of total factor productivity (TFP) is applied:

$$\log (\mathrm{TFP})_{jt} = \alpha_j + \mathrm{X}_{jt}\beta + \mathrm{Z}_{jt}\gamma + \varepsilon_{jt} \qquad \textbf{(1)}$$

(where X includes the employee characteristics (gender composition, age diversity, racial diversity and educational/training dispersion) for firm *j* over time *t*; Z represents model controls such as plant size, value-added, working hours; α_j is the unobservable firm effect (correlated with the explanatory variables) and ε_{jt} is the error term)

For estimation purposes employee characteristics include the polynomial of the average age of employees, the standard deviation of the categories of employee ages, the standard deviation of the average training and education years, the standard deviation of the different categories of share of female employees and the standard deviation of the share of different racial groups. The standard deviations of the employee characteristics are viewed as measures for firm-based employee diversity. It is important to note that standard deviations of employee characteristics will measure group diversity, because it is assumed in the model that all employees are affected in the same way. In order to circumvent possible correlation between unobservable firm effects and employee characteristics the model is also estimated with firm-fixed effects. In practical terms the estimation of fixed effects entails an additional ordinary-least-squared (OLS) estimation in which firm-scale effects (size of the firm measured in terms of the number of employees) and the technological characteristics (age of the firm) are taken into account.

The adapted version of the firm-based model for this particular study includes specific categories for the age, education and training, gender and race attributes. For the age attribute three sub-categories are included, namely i) a greater concentration of employees younger than 35 years ii) a greater concentration of employees between 35 and 55 years of age and iii) a greater concentration of employees 55 years and older. In terms of the education and training attribute of the workforce the model includes two categories, namely a greater concentration of a non-tertiary education/training level (not more than a grade 12 education/training level) and a greater concentration of employees with a tertiary education and training level (any post-grade 12 education/training). For the gender attributes of the workforce three categories are included, namely a less than 25% share of females, a 25-30% share of females and a more than 30% share of females in the workforce. Lastly, in terms of the race attributes the model includes a category where one specific race group has a more than 60% representation in the workforce, a category where the representation of one specific race group is between 40 and 60% and a category where no single race group has a representation of more than 40% in the workforce. The different categories for the different employee attributes are compiled in such a way that the estimation results can be compared with similar or related research results.

For the relational individual-level productivity model an employee remuneration model is used:

$$\log(\mathrm{w})_{\mathrm{ijt}} = \alpha_{\mathrm{ij}} + \mathrm{N}_{\mathrm{it}}\lambda + \mathrm{M}_{\mathrm{ijt}}\mu + \mathrm{X}_{\mathrm{ijt}}\beta + Z_{jt}\gamma + \varepsilon_{ijt} \quad \textbf{(2)}$$

(where N includes individual demographic characteristics, M describes the relational demographic variables, X and Z are the same as in the firm-based model)

The relational individual-level model is based on the assumption that real wages reflect labour productivity levels. The individual-level demographic variables included in N are the square of age, education and training and dummies for female employee participation and race. The relational demographic variables included in M are an age dissimilarity index, an education and training dissimilarity index, a gender dissimilarity index and a race dissimilarity index. A dissimilarity index measures an employee's difference from all the other employees in the same firm. It is thus simply defined as the square root of the average of the squared deviation an employee's characteristic has from the corresponding characteristic of each one of the other employees. The dissimilarity index allows the diversity effects to vary according to the degree of difference between an employee and other employees in the workplace. The aim of the dissimilarity indexes is to determine to what extent complementarity of employees in terms of age, education and training, gender and racial differences will impact on labour productivity and on individual real wages. The dissimilarity indexes are:

$\mathrm{Age}_{\text{dissimilarity i}} = \sqrt{\frac{1}{n}\sum_{k=1}^{n}(Ai - Ak)^2} = \sqrt{(Ai - A)^2 + Var\,(A)}$

The education and training dissimilarity index equation is:

$\mathrm{Education}_{\text{dissimilarity i}} = \sqrt{\frac{1}{n}\sum_{k=1}^{n}(Ei - Ek)^2} = \sqrt{(Ei - E)^2 + Var\,(E)}$

The gender dissimilarity index equation is:

$\mathrm{Gender}_{\text{dissimilarity i}} = \sqrt{\frac{1}{n}\sum_{k=1}^{n}(Gi - Gk)^2} = \sqrt{(Gi - G)^2 + Var\,(G)}$

The race dissimilarity index equation is:

$\mathrm{Race}_{\text{dissimilarity i}} = \sqrt{\frac{1}{n}\sum_{k=1}^{n}(Ri - Rk)^2} = \sqrt{(Ri - R)^2 + Var\,(R)}$

A dissimilarity index will be equal to the standard deviation of an employee characteristic (age, education/training, gender and race) in the firm if an employee has exactly the same characteristic as the firm employee characteristic average.

Both the firm-based and individual-based models are estimated with OLS. This is done for each firm in the sample group. In order to circumvent the biasing of estimation results (due to possible correlation between unobservable characteristics and explanatory variables) fixed-effect models (within – individual variation) are estimated. Unobservables that correlate with the employee's relational position within the employee group are removed (for example, firms that are deliberately employing a better educated workforce would result in a correlation between an employee's education/training levels with firm unobservables).

2.3 Data collection process

The manufacturing industry of Gauteng Province of South Africa was identified as a case study given i) the importance of Gauteng Province to the GDP of South Africa and ii) the important contribution of the manufacturing industry to the gross geographic product of Gauteng

Province. The data is firm-based, and contact information on firms was supplied by the Manufacturing Sector Education and Training Authority (CATHSSETA), the Manufacturing, Engineering and Related Service Education and Training Authority (MERSET) and the Department of Labour. For the purposes of this study three different firm sizes are identified: firms that have fewer than 50 employees, those that have 50 but fewer than 100 employees and firms that have more than 100 employees. Given the aforementioned size constraint, the availability of data and statistical validation requirements, the sample response sizes (82 firms that had fewer than 50 employees, 46 firms that had 50 but fewer than 100 employees and 36 firms that had more than 100 employees) were found to be statistically significant.

The sample period is the calendar years of 2010 to 2012. In order to compile an employee-employer data set for the firms, data had to be collected and computed on real average employee remuneration levels, value added (real sales), average age of employees, the average shares of the different age groups (younger than 35 years, between 35 and 55 years of age and older than 55 years of age), average years of education and training, the weights of employees with a non-tertiary education/training (non-post-grade 12) and with a tertiary education and training (post-grade 12), the average share of female employees and the average racial composition. This was done for each individual firm in the sample group. Individual relational employee data was constructed in order to establish dissimilarity indexes for age, education and training, gender and race attributes for each firm. The mean values and standard deviations for the employee-employer data set (all the firm-level and individual-level variables) are listed in APPENDIX A.

In terms of the descriptive statistics of the constructed total employer-employee data set i) the average age of the workforce of the sample group is about 39 years of age, ii) the majority of the employees in the sample group is between 35 and 55 years of age, while the employees older than 55 years of age constitute only 7.6% of the average workforce, iii) the average number of years of education and training of the workforce in the sample group is about 8 years and the majority of the workforce (63.3%) had a non-tertiary (post-grade 12) education and training, iv) the majority of the firms (78.9%) in the sample group have a female presentation of less than 30% of the workforce and v) the majority of the firms (75%) experienced a situation in which one specific race group had a 40% and more representation in the workforce.

4. THE ESTIMATION RESULTS

The estimation results for the different estimators of the firm-based employee diversity productivity models are listed in TABLE 1.

TABLE 1: Firm-based employee diversity productivity estimates

	log(TFP) *OLS*	*Log(TFP)* *Fixed-effects*
Average age	-0.271	-0.071
	(0.311)	*(0.291)*

	log(TFP) OLS	Log(TFP) Fixed-effects
Standard deviation of age		
greater concentration younger than 35	0.026	0.012
	(0.012)	*(0.013)*
greater concentration between 35 and 55	0.844	0.713
	(0.067)	*(0.098)*
greater concentration older than 55	-0.009	-0.002
	(0.001)	(0.0005)
Standard deviation average years of education and training		
greater concentration non-tertiary education and training	-0.431	-0.223
	(0.017)	*(0.011)*
greater concentration tertiary education and training	1.733	1.219
	(0.951)	*(0.881)*
Standard deviation of gender distribution		
share of females (less than 25%)	0.027	0.019
	(0.002)	*(0.003)*
share of females (between 25 and 30%)	0.153	0.103
	(0.087)	*(0.091)*
share of females (more than 30%)	0.734	0.671
	(0.054)	*(0.044)*
Standard deviation of racial composition		
more than 60% presentation of one specific race group	-0.322	-0.197
	(0.097)	*(0.056)*
between 40 and 60% presentation of one specific race group	0.934	0.881
	(0.072)	*(0.056)*
less than 40% presentation of one specific race group	1.739	1.233
	(0.978)	*(0.833)*
Firm-size		
less than 50 employees		0.072
		(0.021)
between 50 and 100 employees		0.021
		(0.041)
more than 100 employees		-0.012
		(0.01)

	log(TFP) OLS	*Log(TFP) Fixed-effects*
Age of firms		
Older than 15 years		0.008
		(0.001)
Between 10 and 15 years		0.014
		(0.003)
Less than 10 years		0.298
		(0.166)

Source: *Author's analysis*

*(the standard errors are significant at a 10% confidence level and are in parenthesis)

The firm-based estimation results are interpreted in the following paragraphs.

The OLS estimates for the log(TFP) fixed-effect estimations are smaller than the OLS estimates for the log(TFP) estimation, but the signs of the estimates are the same for both estimations. The impact (positive or negative) of the different employee diversity attributes on labour productivity is thus the same for both OLS estimations.

The negative sign for the average age estimate indicates a negative impact on labour productivity for a firm when the workforce becomes older. This result becomes more evident when the OLS estimates for the three different age categories are considered. For both the younger than 35 years and the 35 to 55 years age categories the estimates are positive. A higher concentration of employees in these two categories will result in higher levels of labour productivity, while a higher concentration of employees in the 55 years and older category will have a negative impact on labour productivity. The estimates indicate that the greatest positive impact on labour productivity for the average firm in the sample group should be when the concentration of employees in the 35 to 55 year category increases. The results also indicate that for the average firm a less diverse workforce in terms of age will have a greater positive impact on labour productivity (except for the older than 55 years category). This particular result is a confirmation of the Van Zyl (2013) finding in which it was indicated i) that on average the skill levels of employees in the 35 – 55 category was the highest, thus resulting in higher positive labour productivity levels and ii) that a greater concentration level of employees around a similar age category could result in greater labour productivity benefits for a firm.

The OLS estimates for a higher concentration of employees with a non-tertiary education/training are negative, while the OLS estimates for a higher concentration of employees with a tertiary education/training are positive. Thus, for the average firm in the sample group higher concentration levels of employees with a non-tertiary education and training will have a negative impact on labour productivity, while higher concentration levels of employees with a tertiary education and training will have a positive impact on labour productivity. The relative large magnitudes of the positive estimates are an indication of the strong impact that a greater concentration of employees with a tertiary education and training will have on labour productivity for the average firm. The results are a confirmation that a less diverse labour force in terms of education and training levels and biased towards greater levels of education and training is important for improving labour productivity levels for firms. These

results are similar to the Hamilton et al. (2004) and Ilmakunnas et al. (2011) studies, which also indicate that educational diversity does not necessarily result in higher levels of labour productivity.

The OLS estimates for all three categories of female participation in the workforce are positive, indicating that greater levels of female participation impact positively on labour productivity. It is important to note that the positive estimates increase as the share of females in the workforce increases, indicating that a more gender-diverse workforce will impact positively on labour productivity. These results are also in line with the findings of Roberge et al. (2010), Hoogendoorn et al. (2011), Vandenberghe (2011), Haile (2012) and Garnero et al. (2013), which indicated that greater levels of gender diversity result in greater labour productivity benefits for a firm.

The OLS estimates for the race attribute of the workforce indicate that an increasing participation share of one specific race group has a decreasing impact on labour productivity. From the results it can be concluded that when the participation share of one specific race group exceeds a 60% threshold the impact on labour productivity becomes negative (negative sign of the OLS estimates). The fact that the estimates become positive (and increase in magnitude) as the participation rates of the different race groups become more equitable is an indication that a more racially diverse workforce should impact positively on labour productivity.

The OLS estimates for the fixed-firm effects indicate that a smaller workforce (size of firm) has a greater positive impact on labour productivity and that younger firms (age component) have a greater positive impact on labour productivity. Similar research findings in this regard attribute this to more efficient and dynamic human resource management processes, highly efficient employer-employee interaction, implementation of latest technologies, better operational skills, effective location of firms and a higher level of coherency within the workforce (Iranzo et al., 2008 and Alesina et al., 2005).

The results of the individual employee relational estimates are listed in TABLE 2.

TABLE 2: Individual employee relational remuneration model estimates

	log(wage) OLS	*Log(wage) fixed effects*
Individual employee characteristics: age		
younger than 35	0.042	0.081
	(0.017)	*(0.018)*
between 35 and 55	0.074	0.075
	(0.057)	*(0.018)*
older than 55	-0.003	-0.007
	(0.004)	*(0.0003)*
Individual employee characteristics: education/training		
non-tertiary education/training	0.021	0.030
	(0.013)	*(0.014)*

	log(wage) OLS	*Log(wage) fixed effects*
tertiary education/training	0.057	0.077
	(0.051)	*(0.081)*
Individual employee characteristics: gender		
share of females (less than 25%)	-0.067	-0.079
	(0.006)	*(0.004)*
share of females (between 25 and 30%)	-0.033	-0.045
	(0.067)	*(0.081)*
share of females (more than 30%)	-0.011	-0.013
	(0.024)	*(0.046)*
Individual employee characteristics: race		
more than 60% presentation of one specific race group	0.129	0.193
	(0.057)	*(0.016)*
between 40 and 60% presentation of one specific race group	0.437	0.411
	(0.032)	*(0.026)*
40% presentation of one specific race group	0.733	0.672
	(0.078)	*(0.033)*
Firm characteristics: Standard deviation of age	0.631	0.511
	(0.118)	*(0.201)*
Firm characteristics: Standard deviation of education/training	0.388	0.297
	(0.104)	*(0. 098)*
Firm characteristics: Standard deviation of share of females	-0.619	-0.512
	(0.244)	*(0.188)*
Firm characteristics: Standard deviation of race	0.722	0.613
	(0.341)	*(0.222)*
Age dissimilarity		0.023
		(0.011)
Educational/training dissimilarity		-0.034
		(0.009)
Gender dissimilarity		0.041
		(0.015)
Race dissimilarity		-0.062
		(0.022)

Source: *Author's analysis*

*(the standard errors are significant at a 10% confidence level and are in parenthesis)

The individual employee relational remuneration model estimate results are interpreted in the following paragraphs.

The signs of the estimates for both the log(wage) OLS and the log(wage) fixed-effect OLS estimations are the same indicating that the impact on labour productivity and real wages is the same.

The estimates for the age characteristic of individual employees represent a concave wage profile, indicating positive linkages to real remuneration levels and labour productivity in both the younger than 35 year and 35 to 55 year age groups. The positive estimates for the 35 to 55 year age group are stronger which means that individual employees in this age group experience strong positive real remuneration and labour productivity linkages. The real remuneration and labour productivity linkage for the older than 55 year age group is negative. Individual employees in this age category experience negative real remuneration and labour productivity linkages.

The estimates for the education and training characteristic of individual employees are positive for both the non-tertiary and tertiary education and training categories. Individual employees are thus experiencing positive real remuneration and labour productivity linkages, as higher levels of education and training levels are accomplished. Thus, an increase in education and training has a positive impact on labour productivity and on real remuneration. The positive linkage is stronger for individual employees with a tertiary education and training.

The OLS estimates for all three female participation categories are negative, but the negative estimates become smaller as the share of females in the workforce increases. The negative estimates are an indication of the existence of a remuneration gap between male and female employees (doing the same job). The remuneration gap results in negative linkages between real remuneration and labour productivity for female employees. Individual female employees experience a smaller remuneration gap when the female participation rate in the workforce increases. The result is a smaller negative linkage between real remuneration and labour productivity.

For all three of the racial composition categories the OLS estimates are positive. The estimates increase as the racial diversity of employees increases. This result is an indication that individual employees experience a decrease in remuneration disparities and a subsequent positive impact on labour productivity in a more racially diverse workforce.

In terms of firm characteristics, the OLS estimates for the standard deviation of average age, education/training and race are all positive, but negative for the standard deviation of the share of females. These results indicate that i) a more age-diverse workforce is positively linked to individual remuneration levels and thus to labour productivity, ii) a less diverse workforce in terms of education and training (biased towards higher levels of education and training) creates positive spill-over effects that are positively linked to individual real remuneration levels and higher labour productivity levels, iii) greater levels of racial diversity have a positive impact on individual remuneration rates and labour productivity, and iv) lower levels of gender diversity increase the individual remuneration gap for females, thus resulting in lower levels of labour productivity.

The dissimilarity index estimates include only relative demography variables and not firm-based demographics. The OLS estimates for the age and gender dissimilarity indexes are positive, while the estimates for the education and training and race dissimilarity indexes are negative. The age dissimilarity index estimate suggests that complementarity between employees of different

ages results in higher real remuneration levels and productivity levels, but that the real remuneration and productivity benefits are not equal for all employees in an age-diverse firm (the firm-level results suggest higher real remuneration and productivity benefits for employees in the 35 to 55 age bracket). The negative estimate for the education and training dissimilarity index suggests no complementarity for employees of different education and training backgrounds, thus resulting in lower real remuneration and labour productivity benefits for employees with lower levels of education and training (the benefits are biased towards employees with higher levels of education and training). The positive estimate for the gender dissimilarity index suggests that complementarity between employees of the two different gender groups should result in higher real remuneration and productivity benefits, but the small value of the estimate also indicates that these benefits are not equally distributed in an environment where remuneration gaps exist. The negative sign of the race dissimilarity index suggests that a lack of complementarity between employees of different race groups results in lower real remuneration and productivity benefits if the share of one specific race group increases.

The main conclusions that can be deduced from the estimation results (for the sample data) of both models are: firstly, a less age-diverse workforce (and biased towards the 35 to 55 age category) creates higher real remuneration and labour productivity benefits. Secondly, greater real remuneration and labour productivity benefits are only possible if employees attain higher education and training levels. Thirdly, greater levels of gender diversity in which higher levels of female participation and the elimination of remuneration gaps for females is promoted should result in real remuneration and labour productivity benefits for employees and the firm. Fourthly, a more racially diverse workforce should create higher real remuneration and labour productivity benefits for employees and firms.

5. SUMMARY AND CONCLUSION

The aim of the article was to determine the impact that employee diversity attributes have on labour productivity in the South African workplace.

The results of this study should provide human resource practitioners and specialists in the labour economic field with a greater inside into the dynamics of the impact that employee attributes might have on labour productivity in the South African workplace. Firstly, this particular study serves as a further confirmation of the importance of higher levels of education and training (skill enhancement) especially for the younger employee category as a pre-requisite for greater levels of labour productivity. Secondly, it is generally reported that the participation rate of females in the South African workplace is not at efficient and equitable levels and that remuneration gaps between female and male employees still exist. Greater levels of female participation rates and the elimination of remuneration gaps are of great importance if labour productivity is to be enhanced. Finally, the results indicate that a more racially diverse workforce should induce higher levels of labour productivity. This particular issue will create difficulties for human resource practitioners given the focus of current labour legislation and political objectives, according to which the racial composition of employees in the workplace is prescribed (ideally representing the racial composition of the South African society).

Further extensions of this particular study are possible, including i) geographical and industry differences and ii) the gender attributes of different job positions.

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ANNEXURE A: Summary of the sample statistics

Variable	*Mean*	*Standard deviation*
Firm-level variables		
log(TFP)	2.086	0.471
log(average hourly remuneration)	6.568	0.266
log(value added/hours worked)	2.854	0.589
average age	39.14	2.759
share of age		
younger than 35	0.301	1.745
between 35 and 55	0.623	1.187
older than 55	0.076	2.816
average education	9.080	2.933
share of education and training		
non-tertiary education and training	0.633	0.663
tertiary education and training	0.367	0.622
Share of females		
Less than 25%	0.452	0.611
between 25 and 30%	0.337	0.311
More than 30%	0.211	0.199
Racial composition		
more than 60% representation of one specific race group	0.421	0.244
between 40 and 60% presentation of one specific race group	0.329	0.139
less than a 40% representation of one specific race group	0.250	
average age dissimilarity	11.672	2.634
average education and training dissimilarity	3.072	1.007
firm size less than 50 employees	0.547	0.199
firm size between 50 and 100 employees	0.274	0.089
firm size more than 100 employees	0.179	0.073
Number of firm-year observation	164	
Individual-level variables		
log(wage)	6.438	2.381
age	32.437	7.312
Age dissimilarity	10.987	1.998
education	9.672	1.788
education dissimilarity	2.894	0.751
female	0.315	0.196
Race dissimilarity	4.151	1.096
Number of individual observations	5778	