"Sometimes you don't make enough to buy food" - An Analysis of South African street waste pickers' income

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"Sometimes you don't make enough to buy food" - an analysis of South African street waste pickers' income*

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Abstract

In this paper we use income data of 873 street waste pickers in South Africa to assess whether their income is sufficient to make a living and to identify the possible factors that may influence their income. The results can assist policy makers to make informed decisions in designing and implementing policies aimed at improving the street waste pickers' income earning potential. The results of a linear and logistic regression analysis show that street waste pickers' income is low and many of the street waste pickers in South Africa are trapped in persistent and chronic poverty. The findings further show that the only variables under the direct control of street waste pickers that may have a small positive effect on their income are the use of a trolley and the number of hours worked. Most of the variance in the daily income is explained by the prices of, access to, and the quality of recyclable waste collected over which the street waste pickers have little or no control. This leaves street waste pickers with little scope to improve their income and consequently their socio-economic conditions. Local governments can, however, create an environment and infrastructure in which higher levels of quality waste are made accessible to the street waste pickers.

Keywords: waste pickers, income, poverty, waste management, recycling, waste, informal economy.

JEL Codes: E26, I30, J40

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1 Introduction

The labour absorption capacity of the formal economy has fallen dramatically during the past two decades (Ligthelm, 2006; Von Fintel & Burger, 2015). The unemployment rates continued to increase after 1994, despite having one of the longest business cycle upswings in the South African economy, during this period (Von Fintel & Burger, 2015). The labour market seemingly adjusted to a new high unemployment equilibrium (Burger & von Fintel, 2009) pushing more and more people into the informal economy. The informal economy has become an important alternative for people who are unable to secure a job in the formal economy.

Collecting and selling waste in the informal economy is for many waste pickers a way to survive and the only feasible option to escape unemployment. Waste, which is worth nothing to some, is valuable to others as it is used as an input in the production process of many manufacturing industries, making it economically valuable and worth collecting and selling.

Previous national and international micro studies indicate that the income earned by most waste pickers in the informal economy are low and in many cases insufficient to even meet their basic needs for shelter and regular meals (Benson and Vanqa-Mgijima, 2010, p.15; Carrasco, 2009, p.19; Hayami, Dikshit, & Mishra, 2006, p. 49; Gutberlet & Baeder, 2008, pp. 9-10; Masocha, 2006, p. 839; McLean, 2000a, p. 20; Samson, 2010; Schenck, Blaauw & Viljoen, 2012, p. 53; UNESCAP, 2011, p. 20). The income earned by waste pickers is also reported to be irregular and uncertain which subject them to economic insecurity (Carrasco, 2009, p. 17; Gutberlet & Baeder, 2008, p. 9; Medina, 2005, p. 19). Many waste pickers are therefore said to face chronic poverty despite their attempts to generate a livelihood in the informal economy (Masocha, 2006, p. 839).

Studies by Medina (2005, p. 19) and Schenck et al. (2012, p. 55) found that the income earned by waste pickers on landfill sites is relatively higher than the income earned by street waste pickers. Street waste pickers are therefore seen as the lowest income earners in the recycling chain and one of the most vulnerable groups in the informal economy in terms of poverty and low and uncertain incomes (Carrasco, 2009, p. 19; Gutberlet & Baeder, 2008, pp. 9-10; Schenck et al., 2012, p. 52).

Involvement in the informal economy therefore does not necessarily solve the problem of poverty because of the relatively low income and poor conditions of employment in the informal economy (Ligthelm, 2006). This is especially true for participants in the lower tier informal economy activities such as waste picking.

In the literature, a number of national and international studies disclose factors that might have an influence on the income of waste pickers but none of the studies attempted to analyse the income of the waste pickers Most previous studies only report on the size of the waste pickers' income and the determinants of the prices that recycling companies and buy-back centres (BBCs) pay for the different types of waste (Langenhoven & Dyssel, 2007, p. 120; Schenck et al.,

2012, p. 56; Viljoen, Schenck, & Blaauw, 2012). The reason for this might be attributed to the small sample sizes used in the studies. There is therefore a gap in the literature to analyse the level of significance and the extent to which these factors explain some of the income variations amongst street waste pickers. Insight into this might assist policymakers and waste management officials in their decisions regarding the integration of street waste pickers into their waste management plans.

The aim of this paper is to assess whether street waste pickers earn enough to make a living and either move them out of chronic poverty or reduce the poverty gap they face and to identify the factors that may have an influence on their income. This study utilises data from the first ever country wide study of street waste pickers in South Africa to analyse their income and possible determinants thereof. Income data of 873 street waste pickers in 13 major cities in South Africa is analysed. A statistical analysis is applied to test the significance and extent to which the variables possibly contribute to some of the income variation using an ordinary least squares estimation method

The next section highlights the possible factors, identified in the literature that might influence the income of waste pickers in general. This is followed by a description of the research methodology, empirical results and interpretation of the results of the income of the 873 street waste pickers.

2 Literature review

A number of factors relating to the price of the recyclable products, the quantity of recyclable waste collected, demographic characteristics and working conditions that might influence the income of waste pickers in general were identified in the literature and will be discussed next.

2.1 *Prices of recyclable waste*

Prices of recyclable waste are determined by supply and demand factors and have a significant influence on the income-earning potential of waste pickers (McLean, 2000a, p. 10; Viljoen et al., 2012, p. 4). Street waste pickers have very little influence over the prices they receive from the BBCs who buy the recyclable products from them, except to properly sort the waste. The price of mixed waste is substantially lower than what they can earn for properly sorted waste (Viljoen et al., 2012, p. 8).

The market for some recyclable waste is also highly cyclical and any decrease in the price reduces the income earning potential of waste pickers (Langenhoven & Dyssel, 2007, p. 125; McLean, 2000b, p. 6; Tangri, 2010, p. 6). The prices of recyclable waste products that are exported, like paper, plastic, and metals are also subject to exchange rate fluctuations which can impact negatively on the income of waste pickers (Muller & Scheinberg, 2003, p. 16). The weather also has an effect on the waste pickers' income. Waste pickers usually pick less waste during the rainy season (Agunwamba, 2003, p. 118). The buy-back centres also

pay lower prices for wet or damp waste than for dry waste as the damp waste weighs more (Langenhoven & Dyssel, 2007, p. 117; Sentime, 2011, p. 104). The heavier weight of damp waste might compensate for the lower price, but restricts the quantity of waste that a street waste picker can carry over long distances (Viljoen, 2014, p. 39).

2.2 *Quantity of recyclable waste collected*

The income of waste pickers also depends on the quantity of recyclable waste available to them which in turn depends on the quantity of waste generated in the area in which the street waste pickers collect waste. More waste is generated in areas where the incomes of those who generate the waste are high (Medina, 2007, p. 55). Therefore, the wealthier the waste generators are, the higher the income-earning possibilities for waste pickers might be.

2.3 *Demographic characteristics of waste pickers*

Sentime's (2011, p. 104) study in Braamfontein reported that male waste pickers earn higher incomes than female waste pickers. The finding was supported by a study in the Free State by Schenck et al. (2012, p. 52) who also indicated that the average earnings of male landfill waste pickers were greater than their female counterparts. This finding makes sense given the physical effort needed to collect and transport waste.

The study by McLean (2000a, p. 22) in Durban identified age as another factor that has an influence on a waste picker's income-earning potential, with younger waste pickers earning higher incomes than older waste pickers as they are able to work harder.

2.4 *Type of site*

The site at which waste is collected also influences a waste picker's income. A study in the Free State in 2012 amongst 52 street waste pickers and 410 landfill waste pickers found that the incomes earned by street waste pickers are less than what landfill waste pickers earned (Schenck et al., 2012, p. 52). The higher volume and relative ease of access to waste on the landfill sites makes this possible.

A number of other factors that relate to the waste picker's working conditions were also identified as having a possible influence on the street waste pickers' income.

2.5 *Working conditions and practices*

A survey in Kampot, Cambodia, in 2009 and a study in Dhaka City, Bangladesh, in 2008, found a positive correlation between the income of waste pickers and their daily working hours (Ullah, 2008, p. 12; UNESCAP, 2011, p. 20). Benson and Vanqa-Mgijima (2010, p. 21) on the other hand, found that this correlation

is not necessarily positive. Therefore, assessing whether the number of hours worked in a day influences the income of street waste pickers is imperative

The time at which a waste picker starts picking waste might also influence the street waste pickers' income earning potential. The recyclable waste available is limited and benefits the waste picker who finds it first (Benson & Vanqa-Mgijima, 2010, p. 17; McLean, 2000a, p. 19; Sentime, 2011, p. 104).

Some studies identified competition as a variable that might have an influence on the income of waste pickers (Benson & Vanqa-Mgijima, 2010, p. 10; Schenck & Blaauw, 2011, p. 428; Schenck et al., 2012, p. 76). There seems to be a negative relationship between the levels of competition and the income-earning potential of waste pickers. The more waste pickers there are in an area, the less waste is available per waste picker.

A study by McLean (2000a, pp. 15-16) in Durban in 1998 found that waste pickers who uses a trolley to carry the recyclables collected, earned more than those who used other equipment such as bags or those who carried the waste on their heads.

According to standard human capital theory, there is a positive relationship between the level of education and income earned. Job experience and earnings are also expected to have a positive correlation (McConnell & Brue, 1995, pp. 82-84). There is obvious doubt whether this relationship holds for waste pickers as no education or skills are required for being a waste picker.

Factors identified in the literature that might have an influence on the income of the research population, are the price of the recyclable products, the quantity of recyclable waste collected, gender, age, number of hours worked on a day, starting time of waste picking activities, the use of a trolley to collect the waste, educational attainment level and previous job experience

The next section discusses the methodology that was followed in the countrywide survey of waste pickers in South Africa as well as the empirical strategy of the paper.

3 Methodology and research approach

The study uses primary data from a survey-database consisting of qualitative and quantitative data of 914 street waste pickers and 64 BBCs across 13 major cities in South Africa. This was the first national survey of its kind in South Africa and the data was collected between 19 April 2011 and 28 June 2012. A non-probability sampling technique namely snowball sampling was used as there was no sampling frame available on the number of street waste pickers in South Africa. Snowball sampling is a respondent assisted sampling method (Daniel, 2012, p. 111). A total of 873 street waste pickers were willing to reveal their income as part of the above survey. These waste pickers' data form the basis of the analysis.

The literature on waste pickers pointed out that waste pickers generally have low literacy levels. A face-to-face survey approach was therefore adopted for the national study. Babbie and Mouton (2011, p. 249), states that face-to-face

surveys are useful when most of the research population have limited literacy levels. The survey instrument used by Schenck and Blaauw (2011) formed the substance of the structured qualitative and quantitative questionnaire. The questionnaire was revised and suggestions from Melanie Samson, an expert on waste pickers in South Africa, were incorporated in the final version of the questionnaire. The revised questionnaire was pilot tested on street waste pickers who visited the BBCs during the reconnaissance phase of the research.

To analyse the income, non-parametric techniques were firstly used to assess whether the independent variables identified in the literature, as well as those identified in the national study on street waste pickers, cause differences in the income and whether the differences are statistically significant or not (Pallant, 2010, p. 213).

Some of the data collected is only available in categorical or ranked form. For independent variables that have been divided into two groups or categories the Mann-Whitney U test was used to test for differences and the level of statistical significance thereof. For independent variables with more than two groups or categories, the Kruskal-Wallis test was used. The Spearman Correlation test was used to assess the correlation between income and a continuous independent variable.

After identifying the independent variables in the statistical analysis that result in statistically significant differences in the income of street waste pickers, a cross-sectional regression analysis and logistic regression analysis follows. The results will assess whether and to what extent these identified variables explain the variation in the income of the street waste pickers.

4 Results and interpretation of the findings

4.1 *Income of street waste pickers*

Street waste pickers are divided into two groups based on their income earning intervals. The first group, with the largest number of street waste pickers, earns their income on the same day on which they have picked the waste. The second group consists of street waste pickers who store their waste and sell it on a weekly basis. From the total of 873 street waste pickers who revealed their income, 751 earn their income on the day on which the waste was collected, while 122 received their income after collecting waste for a week. Due to the uncertainty and variation in the incomes earned by street waste pickers, the income data collected in the survey covered three different income scenarios, namely the income usually earned for a day or week, the income earned on a good day or week, and the income earned on a bad day or week. The analysis of the results will be based on the income earned on a usual day and usual week, unless stated otherwise.

The mean and median income earned by street waste pickers for a usual, good and bad day and for a usual, good and bad week is illustrated in Figure 1. The relatively large difference between the mean and median incomes is due to

only a few outliers. The median income is therefore a better indication of the income earned. The data reveals that half of the street waste pickers usually earn R50[1] or less for a day's waste and R300 or less for a week's waste. The median income on a good day or week is R120 and R500 respectively. On a bad day, the street waste pickers' median income is R25 for a day and R150 for a week. It was also found that 75 per cent of the street waste pickers earn a usual income of R85 per day or below.

The national figures do not distinguish between the variation in the various cities and towns in South Africa. Table 1 shows the income usually earned by street waste pickers in each of the 13 major cities covered in the national study.

The results from the four major cities with the most street waste pickers reveals that the street waste pickers in the city of Johannesburg are relatively better-off in terms of the mean and median income than those in Cape Town, Durban and Pretoria. The income in the smaller cities varies and no discernible pattern is immediately evident.

In order to form an idea as to the effect of the income earned on the poverty position of the waste pickers, a comparison with an appropriate poverty line is needed. As Budlender, Leibbrandt and Woolard (2015) suggest all poverty lines are fairly problematical. The notion that a person can for example be in poverty while earning R999 a month, but not in poverty when earning R1000 a month, is of concern. This would entail a discontinuity in people's welfare functions of which no evidence has been found (Budlender et al., 2015). Despite this concern, Budlender et al. (2015) agree that the use of a poverty line does provide some form of comparison but caution that the results need to be interpreted carefully.

Using the official upper-bound poverty line, the per capita income needed to lift a person out of poverty is R636 per month in 2012 prices when the study was conducted (StatsSA, 2014). For a family of four (which was found to be the average number of dependents who rely on a street waste picker's income), this amounts to R2544 per month. Based on the median income of street waste pickers of R50 per day or R300 per week, half or even more of the street waste pickers fall far below that poverty line. Many street waste pickers also cannot afford to buy enough food as stipulated by the Food Poverty Line (FPL). The FPL amounted to R321 per capita per month in 2011 prices and around R329 in 2012 prices. For a family of four, R1316 is needed to meet the FPL.

The best possible scenario for street waste pickers is that all street waste pickers who earn a day income, earn the usual day income for five days in a week and four weeks in a month and those who earn a week income earn it for four weeks in a month. Assuming this scenario applies and each individual's monthly income is compared to the monthly income needed to sustain his (her) household in terms of the number of dependents it is clear from Table 2 that only 47.3 per cent of the street waste pickers will not have a shortfall.

However, the best case scenario is not the rule but the exception. Not all street waste pickers receive R50 for five days of the week or R300 for each week

[1]The exchange rate on 19 October 2012: 1 GBP = 13.8578 ZAR and 1 USD = 8.6614 ZAR, retrieved from Exchangerates.org.uk.

of the month. Clearly, the income of the majority of the street waste pickers is not even enough to sustain their family's daily food intake and therefore also not enough to lift them out of poverty.

The large differences between the incomes earned on a good, usual and bad day or week confirms the claim that the street waste pickers' income is uncertain. This uncertainty is caused by price fluctuations, differences in the prices of the different recyclable waste products and the uncertainty of the type and quantity of waste the street waste pickers will be able to collect on any given day. Because of this uncertainty, street waste pickers cannot predict or estimate what their income will be, making it difficult for them to plan ahead. The uncertainty is also reinforced by the price differences between BBCs in the same area, which is another aspect identified in the literature to have an influence on the income of street waste pickers

4.2 *Prices of recyclable waste products*

The differences in the prices of recyclable waste products make certain products more valuable. The higher the volume of the more valuable recyclable waste products collected by a street waste picker, the higher the income will be.

Table 3 shows the minimum, maximum, mean and median prices per kilogram of the different types of recyclable waste products on a national level in 2012. The price information is based on data collected from 69 BBCs across the 13 cities covered in the national study.

One would expect street waste pickers to be selective in the type of waste they collect to get the highest possible income per kilogram of waste collected. However the data show that a mere 72 or 7.9 per cent of the street waste pickers collected only one specific recyclable waste product and the results are shown in Table 4.

Of these 72, only 68 revealed their income. These street waste pickers mostly collected white paper followed by plastic products, metals and cardboard. Very few collected only glass or only cans. The mean income for the street waste pickers who only collected plastic was the highest at R86.50 a day and R686.43 a week followed by a mean day and mean week income of R66.60 and R350 respectively for cardboard and a mean day income of R43.00 and mean week income of only R140 for white paper. The mean income for those who only collect glass or cans amounted to R20 and R11 a day respectively. The Kruskal-Wallis test however shows no statistically significant differences between the income and waste products in which the waste pickers specialises (See Appendix Table A2 for the Kruskal-Wallis test results).

Low level of specialisation in only one product might also be ascribed to the scarcity of the higher valued recyclable waste products (Viljoen, 2014, p. 236). Street waste pickers earning the highest mean week income (R604.10), are those who collect almost all types of waste products including plastic, paper, glass, metal, and cans.

The combinations or types of recyclable products as well as the weight of each type of waste product collected by an individual street waste picker differ

from day to day. Because the capturing of data on the exact combination and weight of each recyclable waste product collected by each individual street waste picker was not part of the national study, the price variable cannot be included in a regression analysis to test the relationship between the prices and the income. A micro study to collect this type of data might reveal interesting insight into the income-price relationship.

The statistical and cross sectional regression analysis that follows will use the factors other than the quantity mix and price, identified in the literature that might influence the income of street waste pickers namely gender, age, educational attainment level, previous job experience, other training, starting time of waste picking activities, number of hours worked on a day, and whether they use a trolley to collect the waste or not. Additional factors that emerged from the national study that might also influence the street waste pickers' income were also included in the analysis. These factors are the street waste pickers' country of origin, whether the street waste picker is part of a group or not, and their marital status. For the results of the Mann-Whitney, Kruskal-Wallis and Spearman Correlation tests (see Annexure 1).

4.3 *Gender of street waste pickers*

The data as presented in Figure 2 reveals that male street waste pickers tend to earn a higher income than female street waste pickers.

The Mann-Whitney U test reveals statistically significant differences at a 1 percent confidence level between the usual day and usual week income of females and males. The median usual day income of female street waste pickers of R42.50 is around 80 per cent of that of the R50 of male street waste pickers. The median usual week income of females is only R200 or half of that of the males. The reasons for this might be related to the females' family responsibilities preventing them from starting early in the morning or working long hours. Females might also collect less waste due to the lack of physical ability and strength to carry heavy loads over long distances.

4.4 *Age of street waste pickers*

The Spearman correlation test shows a negative, statistically significant correlation at a 1 percent confidence level between age and both the usual day and usual week income. It therefore seems that the income potential is higher for younger street waste pickers than for older street waste pickers. The reasons why younger street waste pickers are earning more than the older street waste pickers might be related to the fact that they are usually physically more able to move quicker and might be able to collect and manage higher and heavier volumes of waste.

4.5 *Foreign-born versus. South-African born street waste pickers*

From the income data as depicted in Figure 3, it appears that foreign-born street waste pickers earn both higher median day and week incomes than the South African-born street waste pickers.

The results of the Mann-Whitney test however, reveal that the differences for the usual day income between South African versus foreign-born street waste pickers are not statistically significant but for the usual week income the difference is statistically significant at a 1 percent confidence level. It might be that the foreign street waste pickers tend to live and work together and might have storage space which enables them to sell larger volumes. The mean week incomes of street waste pickers who work in a group compared to those who do not work in a group are summarised in Table 5.

The mean usual week income of the street waste pickers from Lesotho and Zimbabwe is much higher at R844.95 and R700.00 respectively compared to the R243.85 of the South African street waste pickers who work in a group. The mean incomes of South African street waste pickers are far less than the national mean usual week income of R505.06. The Mann-Whitney test also shows statistically significant differences at a 1% confidence level between the usual week income for street waste pickers who work in a group and those not working in a group. There is no statistically significant difference for the usual day incomes.

4.6 *Type of equipment used*

The income results as shown in Table 6 indicate that street waste pickers who use a trolley are better off than those who use bags, wheelbarrows and their heads to carry the waste. The median usual day income is almost 50 per cent higher whereas the median usual week income is double for street waste pickers with trolleys.

The Mann-Whitney test results confirm the income differences at a statistically significant confidence level of 1 percent. A trolley therefore makes it easier to carry higher volumes of waste over longer distances.

4.7 *Education, previous job experience and other training*

The income data and test results show no statistically significant difference between the usual day and week incomes of street waste pickers and the level of education, previous job experience and other training. It makes sense as street waste picking activities require no skills, education or previous experience making it an income earning opportunity for the most vulnerable groups of people.

4.8 *Number of hours worked*

The Spearman correlation test was used to test the correlation between the number of hours worked in a day as an independent continuous variable and the usual day and usual week income. The results show a statistically significant positive correlation at a 1% confidence level, between the usual day income and the number of hours worked in a day but no statistically significant correlation for the usual week income and the number of hours worked in a day. Long working hours therefore do not necessarily translate into high incomes as indicated by Benson and Vanqa-Mgijima (2010, p. 21). Reasons for this might be that recyclable waste products are not freely available every day of the week.

4.9 *Starting time*

The results of the Spearman correlation test prove that there is a statistically significant negative correlation at a 5 percent confidence level between the income for a usual day and the starting time of the waste picking activities. There is also a statistically significant negative correlation at a 1 percent confidence level between the income earned for a usual week and the starting time of the waste picking activities. This implies that the earlier the street waste pickers start, the more waste is available before the municipal trucks empty the dustbins. The early starters might also get to the more valuable waste first.

4.10 *Marital status*

Differences between the incomes earned by street waste pickers and their marital status revealed that the widowed, single and divorced street waste pickers earned the lowest median income. Those living with a partner or who are married earned the highest median incomes. These differences are statistically significant at a 5 percent confidence level for the usual day income, but not statistically significant for the usual week income. Street waste pickers living with a partner or who are married might be able to work harder because family responsibilities are shared between them.

To test whether and to what extent the independent variables explain some of the income variation, a cross-sectional regression analysis was performed for the usual day income data as the majority of street waste pickers earn day incomes. The results of the cross sectional regression analysis for the usual week income showed that no independent variables caused statistically significant differences.

5 Cross-sectional regression analysis

All variables identified in the literature and in the national study amongst street waste pickers, which might cause differences in the income, were added in an initial model. None of the independent variables that did not show statistically significant differences in the statistical analysis, showed statistically significant differences in the initial model.

Only the variables that showed statistically significant differences in the statistical tests were therefore used to specify Model I and II (see Table 8).

Usual day income = f (Male, Age, Trolley, Duration, Education, Foreign, Married/living with partner, Start time)

The usual day income was transformed to a natural log function to provide for outliers that can violate the assumption of normality which is common in large samples (Pallant, 2010, p. 62). Table 7 presents the variables used in the analysis and the expected signs of the coefficients. From the statistical analysis, the coefficients of all variables are expected to be positive, except for the age and starting time variables.

The results of the cross-sectional regression model is summarised in Table 8

For Model I, the value of the coefficient of determination (R squared) of 0.126 indicates that 12.6 per cent of the income variance is explained by the independent variables included in Model I. The independent variables that are statistically significant are the MALE variable with a positive coefficient, AGE with a negative coefficient, DURATION or number of hours worked variable with a positive coefficient, and the TROLLEY variable with a positive coefficient, all as expected. This strengthens the literature that female street waste pickers earn less than male street waste pickers and younger street waste pickers have higher income-earning potential. This might all be ascribed to the physical nature of the work, which becomes more difficult to manage for females and older street waste pickers. Street waste pickers who use a trolley to carry their waste also earn a higher income than those using other means to collect waste. Street waste pickers who work longer hours also tend to earn more than those who work shorter hours in a day.

The variables that are not statistically significant are EDUCATION, FOREIGN STARTTIME and MARLWP all whose coefficient signs are as expected. In Model I, the TROLLEY variable contributes most to the variation in the income of street waste pickers. The MALE variable has the second highest coefficient followed by the number of hours worked and age.

In Model II, only the independent variables that were statistically significant in Model I were used. The variables EDUCATION, FOREIGN, STARTTIME, and MARLWP were removed. Model II explains 12.2 per cent of the variation in the usual day income. In Model II, all independent variables are still statistically significant. It shows that street waste pickers cannot increase their earnings with higher educational attainment levels.

The only variables that seem to benefit the street waste pickers and over which they have some control, are the use of a trolley to collect waste and the duration or number of hours spent picking waste during a day. However, these variables have a small positive influence on the income. Thus, there is not much that street waste pickers can do to improve their income-earning potential. Because these models only explain about 12 per cent of the variance in income, it appears that most of the variance in the day income of street waste pickers is explained by unobserved effects such as the prices of the recyclable waste collected and the volume and mix collected. Therefore, street waste pickers rely heavily on the value and mix of the recyclable waste that they collect.

6 Logistic regression model[2]

As the median usual day income of street waste pickers was R50, the binary dependent variable used in the model is a usual day income of 'R50 or less' and 'more than R50'. The independent variables help predict the odds of a street waste picker to earn an income higher than the median income of R50 for a usual day.

The dependent variable takes the value of 1 for a probability of earning 'more than R50' (θ) and the value of 0 for the probability of earning 'R50 or less' (*1-*θ). Two logistic regression models were estimated. For Model I, the same eight independent variables that were used in the linear regression analysis, Model I, are included in the logistic regression model to assess the impact of the independent variables on the likelihood that respondents would have reported a usual day median income of 'more than R50'. These variables are (1) Gender, (2) Age, (3) Trolley, (4) Duration or hours worked on a day, (5) Education, (6) Foreign, (7) Married or living with a partner, and (8) Starting time. For Model II, only the variables which were statistically significant in Model I were used. The variables used in the models, with their coding, are summarised in Table 9.

The logistic regression function is the logit transformation of θ: (SFSU, 2002:2)

$$\theta = \frac{e(\alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i)}{1 + e(\alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i)}] \tag{1}$$

α = the constant of the equation and,
β = the coefficient of the predictor variables.
Or
An alternative form:

$$\log it\ [\theta(x)] = \log\left[\frac{\theta(x)}{1-\theta(x)}\right] = \alpha + \beta_1 x_1 + \beta_2 x_2 \ldots + \beta_i x_i \tag{2}$$

The logistic regression calculates the probability of success over the probability of failure that will be expressed by odds ratios.

One case, for which the standardised residuals for outliers exceeded 2.58 (outliers at the .01 level) were removed from the model as suggested by Menard (2002, p. 583).

The full model against a constant only model was statistically significant, which indicates that the variables or predictors as a set could reliably distinguish between the street waste pickers who reported an income of 'more than R50' and those who reported an income of 'R50 or less' usual day income.

The model explains between 10.4 per cent (Cox and Snell R Squared) and 13.8 per cent (Nagelkerke R Squared) of the variance in the income categories, and correctly classified 64.8 per cent of the cases. The successful prediction

[2] For a detailed discussion of the assumptions and estimation method of a logistic regression model see among others Menard (2002), O'Halloran (2005), Pallant (2010), SFSU (2002) and Wuensch, (2013).

for those falling in the 'R50 or less' usual day income category was 68.6 per cent, and for those falling in the 'more than R50' usual day income category the success rate was 60.6 per cent.

Only two predictors made a statistically significant contribution at a 1 per cent level to the model, namely the age of street waste pickers and whether or not they use a trolley to collect the waste.

The impact of predictor variables is usually explained in terms of odds ratios, which equals the 'exponentiated coefficient' (O'Halloran, 2005, p. 13). The odds ratios indicate how many times more likely the street waste pickers are to fall in the 'more than R50' usual day income category. The odds ratio of street waste pickers who use trolleys is 2.235, indicating that they are twice as likely to earn an income of 'more than R50' than those who do not use trolleys. The odds ratio of 0.963 for age, indicates that for every one additional year of age, street waste pickers are 0.96 times less likely to earn a usual day income of 'more than R50'. The odds ratio less than one can be inverted (Wuensch, 2013, p. 55) indicating how many times more likely the street waste pickers are to earn a usual income of 'R50 or less'. The inverted odds ratio is 1.04.

For Model I, the constant was negative and another model was used in which the variables that were not statistically significant were dropped one by one. Regression Model II, with independent variables that explain the highest percentage of the income variance was estimated. Only the AGE and TROLLEY variables, which were statistically significant in the first logistic regression model, were used.

Logistic Regression Model II was also statistically significant, which indicates that the variables or predictors used, still reliably distinguish between the street waste pickers who reported an income of 'more than R50' and those who reported an income of 'R50 or less' usual day income. The model was statistically significant at a 1 percent confidence level, ($chi\text{-}square = 71.334$, $p < .0005$ *with* $df = 2$). The Hosmer-Lemeshow Goodness of Fit Test supports the significance of the model, with a *chi-square* value of 7.495 and a significance level of 0.484.

Model II explains between 9.3 per cent (Cox and Snell R Squared) and 12.4 per cent (Nagelkerke R Squared) of the variance in the income categories, and correctly classified 65.4 per cent of the cases. The successful prediction for those falling in the 'R50 or less' usual day income category was 69.4 per cent, and for those falling in the 'more than R50' usual day income category the success rate was 60.9 per cent. The contribution of both of these predictors is significant.

Age is again the most important predictor (β =-0.041). The negative sign shows that the older the street waste pickers are less likely to earn a usual income of 'more than R50' than the younger street waste pickers. For using a trolley, (β =0.955) and, as in Model I, suggests that street waste pickers who use trolleys will more likely earn a usual day income of 'more than R50' than 'less than R50'.

The odds ratios show that for every one additional year of age, street waste pickers are 0.96 times less likely to report a usual day income of 'more than R50'. The street waste pickers who use trolleys to collect waste is 2.6 times

more likely to fall in the 'more than R50' usual day income category than in the 'R50 or less' usual day income category.

Both models show that street waste pickers can do very little to increase their odds of earning a 'higher than R50' income for a day's waste. Using a trolley is the only variable that might increase their odds slightly.

7 Conclusion

The high unemployment rate and limited opportunities for the unskilled and semi-skilled in the formal economy forces many to venture into street waste picking activities that have few or no entry barriers. The income earned from these informal economy activities is however not sufficient to lift these people and their dependents out of chronic poverty.

The income of more than half of the street waste pickers is lower than the upper and lower bound poverty lines. The informal street waste picking activities in its current form is therefore only a survival mechanism for most of the street waste pickers. These activities further yield relatively higher income earning opportunities for males and for younger street waste pickers than for females and older street waste pickers. The cross sectional analysis reveals that the only variables that can be controlled by the street waste pickers themselves are to use a trolley to collect waste and to work long hours. These variables however, have a small positive influence on the income. There is therefore not much that street waste pickers can do to improve their income-earning potential.

The ordinary least square models only explain around 12 per cent of the variance in the usual day income. Most of the variance is therefore caused by the prices of the recyclable waste collected and the volume and mix collected. Street waste pickers therefore rely heavily on the value and mix of the recyclable waste that they collect and the prices paid for the recyclable waste products by the BBCs that are not included in the models.

The logistic regression model helped predict the odds of a street waste picker to have earned an income of 'more than R50' for a usual day. Only two predictors made a statistically significant contribution to the model, namely the age of street waste pickers and whether or not they use a trolley to collect the waste.

The results of these models reiterate that despite the income earning opportunities provided by informal street waste picking activities, there is little scope for street waste pickers to improve their income and consequently their socio-economic conditions, leaving around 35 000 to 70 000 street waste pickers in South Africa trapped in persistent and chronic poverty. Local governments can however, through waste management initiatives like separation at source projects, facilitate increased access to waste for street waste pickers. Access to waste is one of the key issues that can improve the income and livelihood of people that have nowhere else to go. Local governments should further facilitate infrastructure such as Material Recovery Facilities (MRF), sorting facilities and BBCs that might assist street waste pickers to collect and sell higher volumes of waste. It is difficult for street waste pickers to sort and clean the waste properly

without a place or space to sort the waste.

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Table 1: Minimum, maximum, mean, and median incomes usually earned for a day or week's waste in the different cities, 2012 (n=873)

Cities	Day					Week				
	N	Min (R)	Max (R)	Mean (R)	Median (R)	N	Min (R)	Max (R)	Mean (R)	Median (R)
Bloemfontein	39	10	250	61.74	40	6	140	400	220	165
Cape Town	152	10	300	64.05	50	1	200	200	200	200
Durban	65	2	200	58.06	45	15	14	700	226.6	200
East London	36	5	175	44.58	30	-	50	50	50	50
Johannesburg	188	2	500	80.65	60	84	60	2000	621.23	400
Kimberley	14	9	95	40.79	40	-	-	-	-	
Mafikeng	6	40	175	79.17	65	-	-	-	-	
Nelspruit	1	65	65	65	65	1	350	350	350	350
Pietermaritzburg	3	25	120	73.33	75	2	300	600	450	450
Polokwane	11	45	100	66.82	70	-	-	-	-	
Port Elizabeth	18	4	125	43.22	35	1	100	100	100	100
Pretoria	212	3	300	68.4	50	12	100	500	301.67	300
Upington	6	12	150	84.5	90	-	-	-	-	
Total	751	2	500	67.26	50	122	14	2000	505.06	300

Source: Survey data

Table 2: Income shortfall for street waste pickers and their dependents, 2012 (n=693)

	N	%
Income shortfall		
Larger than R2000	28	4.04
Between R1001 and R1999	101	14.57
Between R501-R1000	107	15.44
Between R1 and R500	129	18.61
No shortfall and surplus	328	47.33
Total	693	100

Table 3: Mean, minimum, maximum, and median prices and standard deviation of the different recyclable waste products (per kg), 2012 (n=69)

Type	N	%	Mean	Standard deviation	Minimum (Rand)	Maximum (Rand)	Median (Rand)
White paper	55	79.7	1.03	0.545	0.20	2.30	1.00
Coloured Paper	39	56.5	0.45	0.327	0.10	1.50	0.35
Magazines/ books	47	68.1	0.24	0.132	0.05	0.80	0.20
Newspapers	49	71.0	0.22	0.115	0.05	0.60	0.20
Mix paper	46	66.7	0.26	0.199	0.05	1.00	0.20
Cardboard	48	69.6	0.37	0.146	0.15	0.70	0.30
PET	33	47.8	1.22	0.692	0.15	3.20	1.00
HDPE	28	40.6	0.72	0.317	0.15	1.60	0.70
PVC	14	20.3	1.01	1.232	0.10	5.00	0.70
LDPE	28	40.6	0.99	0.507	0.15	2.00	0.95
PP	17	24.6	0.95	0.485	0.15	1.80	1.00
PS	2	2.9	0.38	0.318	0.15	0.60	0.38
Plastic mix	21	30.4	0.54	0.255	0.05	0.90	0.50
Cans	38	55.1	0.63	0.350	0.10	1.50	0.50
Glass	31	44.9	0.23	0.085	0.10	0.40	0.20
Tetrapak	4	5.8	0.53	0.320	0.30	1.00	0.40

Source: Survey data

Table 4: Mean minimum and maximum income received by street waste pickers who specialise in picking only one product, 2012 (n=68)

Product	Income interval	N	Minimum (Rand)	Maximum (Rand)	Mean (Rand)
Paper	Day	18	4	95	43
	Week	1	140	140	140
Cardboard	Day	10	16	200	66.6
	Week	1	350	350	350
Plastic	Day	8	2	200	86.5
	Week	7	100	1400	686.43
Cans	Day	1	11	11	11
Glass	Day	4	10	30	20
Metals	Day	18	8	150	69.06

Source: Survey data

Table 5: Mean week income of street waste pickers who work in a group, 2012

Country of origin	Mean week income	
	Work in a group	Do not work in a group
South Africa	243.85	335.91
Zimbabwe	700.00	508.13
Mozambique	150.00	300.00
Lesotho	844.95	378.33

Source: Survey data

Table 6: Differences between the usual day and usual week income and the use of a trolley, 2012

	Usual day income			Usual week income		
Trolley	**N**	**Median**	**Mean**	**N**	**Median**	**Mean**
Yes	504	60	72.32	94	400	577.41
No	238	40	55.84	28	200	278.39

Source: Survey data

Table 7: Expected signs of the variables' coefficients

Variable	Dummy variable	Continues variable	Expected sign of the coefficient
Gender	MALE		Positive
Age		AGE	Negative
Equipment used	TROLLEY		Positive
Number of hours worked a day		DURATION	Positive
Education level		EDUCATION	Positive
Country of origin	FOREIGN		Positive
Married/living with partner	MARLWP		Positive
Starting time		STARTTIME	Negative

Source: Survey data

Table 8: Summary results of the OLS regression Models I and II

	Model I				Model II			
	B	**Std. Error**	**t**	**Prob**	**B**	**Std. Error**	**t**	**Prob**
Constant	3.741	.282	13.285	.000***	3.707	.175	21.150	.000***
Gender	0.273	.113	2.416	.016**	.291	.111	2.614	.009***
Age	-0.014	.002	-5.732	.000***	-.014	.002	-6.689	.000***
Trolley	0.3	.062	4.835	.000***	.325	.060	5.462	.000***
Duration	0.031	.013	2.419	.016**	.032	.011	2.831	.005***
Education	0.007	.009	0.725	.469	-	-	-	-
Foreign	0.131	.120	1.089	.277	-	-	-	-
Starttime	-0.015	.022	-.647	.518	-	-	-	-
MARLWP	0.074	.060	1.237	.217	-	-	-	-

Models I and II summary

	Model I	**Model II**
R	0.355	0.349
R squared	0.126	0.122
Adjusted R-squared	0.116	0.116
F	11.951	23.72
Obs	671	691
Df	8	4
Prob	0.0005***	0.0005***
Durbin Watson	1.866	1.874

*, **, *** 10%, 5%, 1% level of significance, respectively
Source: Stata output

Table 9: Coding for variables used in the logistic regression models for the usual day income

Dependent variable			
INCOME		0 = R50 or less; 1 = More than R50	
Independent variables coding			
Variable	Continuous	Categorical	Coding
Gender		MALE	0 = Female, 1 = Male
Age	AGE		
Having a trolley		TROLLEY	0 = No, 1 = Yes
Duration or hours worked	DURATION		
Educational attainment level	EDUCATION		
Foreign born		FOREIGN	0 = No, 1 = Yes
Married or living with a partner		MARLWP	0 = No, 1 = Yes
Start early or late in the morning	STARTTIME		

Table 10: Results of the Logistic Regression Model I

Model I	B	S.E.	Wald	df	Prob	Exp(B) (Odds ratio)	95% C.I. for EXP(B)	
							Lower	Upper
Gender	.488	.351	1.930	1	.165	1.629	.818	3.243
Age	-.038	.007	27.043	1	.000***	.963	.949	.977
Trolley	.804	.186	18.765	1	.000***	2.235	1.553	3.216
Duration	.048	.038	1.609	1	.205	1.049	.974	1.130
Education	.041	.027	2.323	1	.127	1.041	.988	1.097
Foreigner(1)	.219	.358	.374	1	.541	1.245	.617	2.510
Start time	-.049	.066	.558	1	.455	.952	.837	1.083
MARLWP(1)	.317	.176	3.266	1	.071	1.373	.974	1.938
Constant	-.214	.835	.066	1	.798	.807		

Source: SPSS output

Table 11: Results of Logistic Regression Model II

Model II	B	S.E.	Wald	df	Prob	Exp(B) (Odds ratios)	95% C.I. for EXP(B)	
							Lower	Upper
Age	-.041	.006	42.780	1	.000***	.960	.948	.972
Trolley	.955	.172	30.667	1	.000***	2.599	1.853	3.644
Constant	.850	.265	10.329	1	.001	2.341		

Source: SPSS output

Figure 1: Mean and median incomes for a usual, good and bad day and week (2012)
Source: Survey data

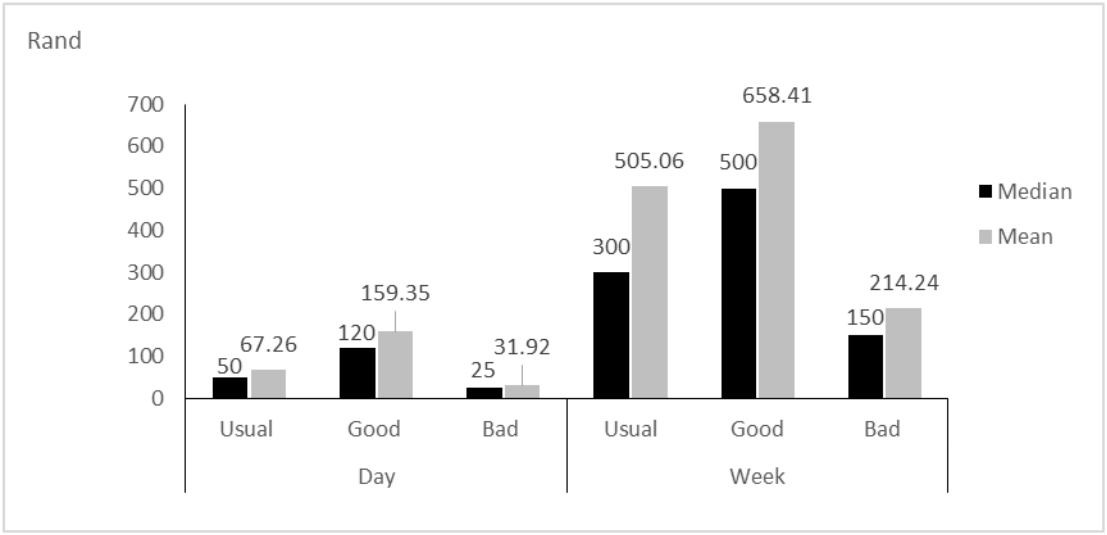
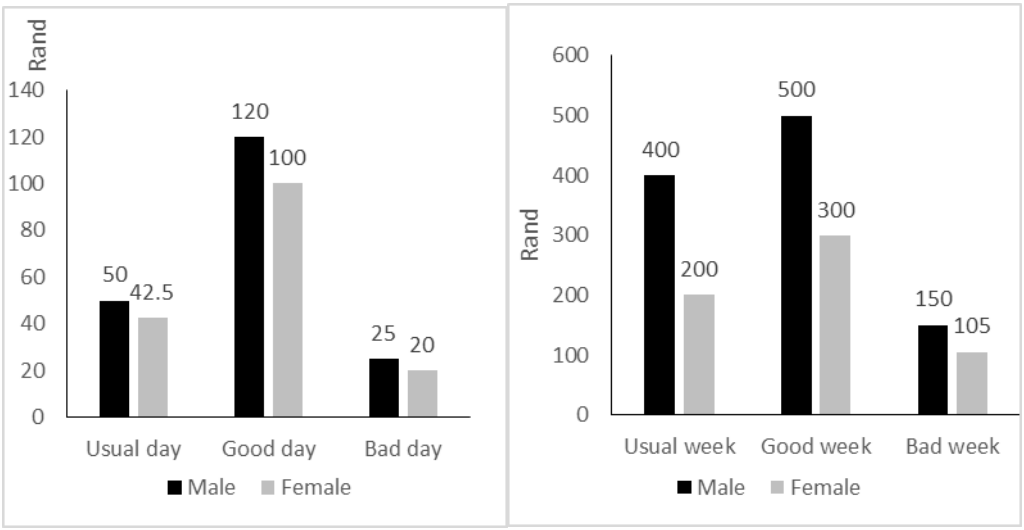
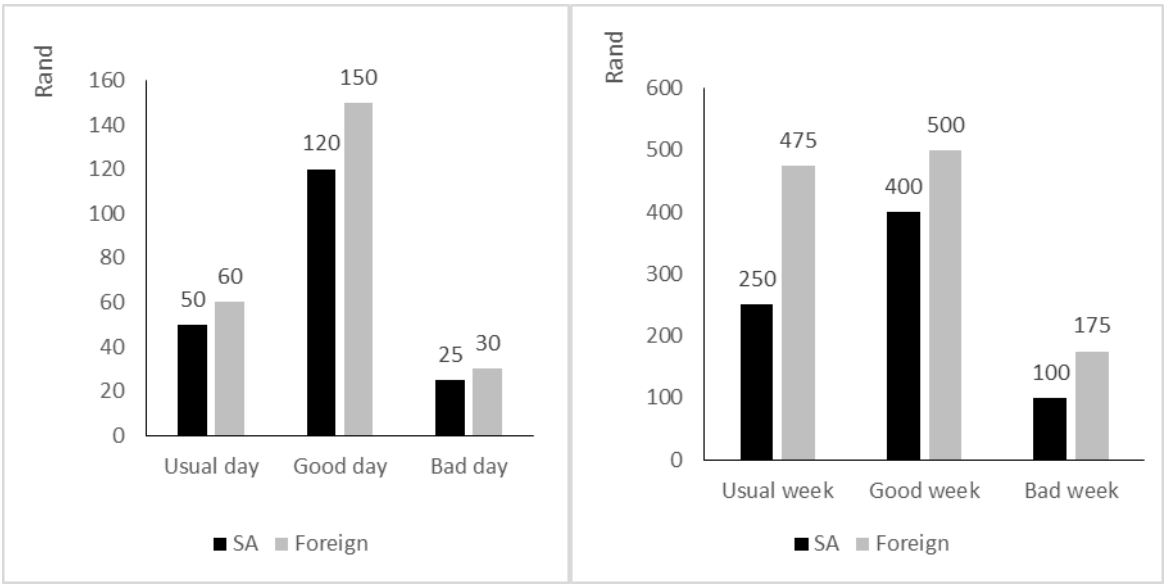


Figure 2: Comparison between the median income for a usual, good, and bad day and week and gender, 2012



Source: Survey data

Figure 3: Comparison between median day incomes for South African-born versus foreign-born street waste pickers, 2012



Source: Survey data

APPENDIX

Table A1: Summary results of the Mann-Whitney tests

	Mann-Whitney U test								
		N	**Mean**	**Standard deviation**	**Median**	**Z**	**p**	**r**	**U**
	Gender								
Usual day	Male	701	68.45	55.979	50	-2.61	***.009	0.10	13669.500
	Female	50	51.5	41.175	42.5				
Usual week	Male	96	569.26	555.909	400	-3.60	***.0005	0.33	673.500
	Female	26	249.44	162.329	200				
Country of origin									
Usual day	SA	700	66.17	53.618	50	-1.89	0.059	0.07	14714.00
	Foreign	50	83.80	73.085	60				
Usual week	SA	56	314.54	305.120	250	-4.49	***.0005	0.41	976.00
	Foreign	66	673.61	600.105	475				
Other training									
Usual day	Yes	147	72.33	57.482	50	-1.34	0.181	*0.05	38150.50
	No	559	65.94	55.239	50				
Usual week	Yes	31	470	428.577	300	-0.19	0.848	*0.02	1332.50
	No	88	513.66	536.799	350				
Previous experience									
Usual day	Yes	381	69.76	61.133	50	-0.23	0.818	*0.01	66586.00
		353	64.71	48.913	50				
Usual week	Yes	66	475.58	429.628	350	-0.16	0.873	*0.01	1686.50
	No	52	579.21	619.119	325				
Using a trolley									
Usual day	Yes	504	72.32	58.509	60	-5.14	***0.0005	0.19	46012.50
	No	238	55.84	45.586	40				
Usual week	Yes	94	577.41	561.071	400	-3.33	***0.001	0.30	769.50
	No	28	278.39	213.364	200				
Part of a group									
Usual day	Yes	174	68.79	51.990	52.50	-0.65	0.514	0.02	48059.50
	No	571	66.86	56.394	50				
Usual week	Yes	53	681.66	652.033	450	-2.62	***0.009	0.24	1321.50
	No	69	376.00	332.690	300				

*; **; *** 10%, 5%, 1% level of significance, respectively

Table A2: Summary results of the Kruskal-Wallis tests

Kruskal-Wallis tests results, 2012						
		N	**Median**	**Chi-square**	**df**	**P**
Specialises in one product						
Usual day	Paper	*18*	*42.50*	*9.714*	*5*	*0.0838*
	Cardboard	*10*	*37.50*			
	Plastic	*8*	*70*			
	Cans	*1*	*11*			
	Glass	*4*	*20*			
	Metals	*18*	*50*			
Usual week	Paper	*1*	*140*	*0.838*	*2*	*0.6577*
	Cardboard	*1*	*350*			
	Plastic	*7*	*700*			
Marital status						
Usual day	Never married or Single	*351*	*50*	*11.63*	*4*	***0.020*
	Separated or Divorced	*76*	*45*			
	Married	*214*	*50*			
	Widowed	*44*	*45*			
	Living with a partner	*58*	*70*			
Usual week	Never married or Single	51	*400*	6.50	*4*	*0.17*
	Separated or Divorced	5	*250*			
	Married	57	*350*			
	Widowed	3	*150*			
	Living with a partner	5	*300*			
Educational attainment levels						
Usual day	No schooling	*48*	*50*	*5.19*	*4*	*0.269*
	Some primary	*210*	*50*			
	Primary schooling	*84*	*50*			
	Some secondary	*345*	*50*			
	Secondary completed	*55*	*60*			
Usual week	No schooling	*6*	*244*	*3.45*	*4*	*0.486*
	Some primary	*53*	*400*			
	Primary schooling	*11*	*300*			
	Some secondary	*43*	*300*			
	Secondary completed	*7*	*300*			

*, **, *** 10%, 5%, 1% level of significance, respectively

Table A3: Summary results of the Spearman Correlation tests

Spearman correlation test					
N		**rho**		**P Coefficient of determination**	
Usual day	**Usual week**	**Usual day**	**Usual week**	**Usual day**	**Usual week**
Age					
744	121	*-0.266*	0-.334	****0.0005*	****0.0005*
Starting time					
738	121	-0.094*	-0.478**	**0.011	***0.0005
Number of hours worked					
706	120	0.144**	0.145	***0.0005	0.113

*, **, *** 10%, 5%, 1% level of significance, respectively