

# Original Research Article

## Factors influencing income inequality in Namibia

### ABSTRACT

*This paper examines factors influencing income per person & inequality using hybrid cob-Douglas and Principal Component Analysis (PCA) was applied. Data source were from Namibia Statistics Agency (2012). The result shows that factors that all explanatory variables were found to be positively and significant at one percent to explain the household income per person, as expected. PCA found that three components extracted explain variation of income equality at about 72% urban jobs stimulates the migration from rural would be more than one rural worker. The result of this paper shows that Namibia does not seem to break the cyclical problem of poverty, unemployment and filling the required skill for better economic growth.*

**Keywords:** Namibia, income, cob-Douglas and PCA

**JEL 240:** Human Capital; Skills; Occupational Choice; Labor Productivity

### 1. INTRODUCTION

Namibia is regarded as an upper middle income country, with a GDP per capita approximately about US\$ 5,293. Over the last ten years, the Namibian economy grew by an average at rate of 5% while recording of inflation rate shows between 5.5% to 7% record. The economy is characterised by heavy reliance on natural resource extraction for the export market, a large non-tradable sector (government services) and heavy dependence on imports, mainly from South Africa, to meet domestic demand for goods and services. The Namibian export is dominated by the primary industry mainly comprising of mining, fisheries and agriculture (NSA, 2012)..

Despite this status, the country is characterised by many social and economic challenges. Income inequality is high a Gini coefficient of 0.59 but has been falling over the past 20 years (from 0.79 to 0.59); the level of poverty and the cost of living are high, and thus quality of life is not in unison with the macroeconomic indicators. The primary industry contribution to GDP has been declining while that of the secondary industry has increased. The tertiary industry continues to be the largest contributor to GDP, accounting for more than half of GDP. . However, the primary industry, especially the agricultural sector, remains an important source of livelihood supporting more than half of the population, but its economic contribution less than 4%. The incidence of poverty is estimated at 29% of the population, with an unemployment rate of 27.4%; HIV/AIDS prevalence rate of stands at 18.2%, and it is estimated that about half the poor population is in severe poverty. The majority of the population is rural-based, but urban poverty is deeper than rural poverty. The human development index is rather low, at 0.61 (ranked 128th out of 186 countries) (NSA, 2012 & 2013).

Thus, apart from internal social and economic challenges, Namibia is largely an open economy, and is therefore vulnerable to the vagaries of world economic fluctuations. This situation is further worsened by the heavy reliance on South Africa for vital imports (NSA, 2012).

Namibian life expectancy at birth has improved and is now estimated at 62.5 years. Infant and under-five mortality rates have also improved and are now estimated to be 32 and 42 deaths per 1000 live births, respectively. With an adult literacy rate of 89 percent, Namibia is one of the countries with the highest adult literacy rates in Africa (Namibia Statistics Agency, 2012).

As part of the initiatives to address the above many challenges, the government crafted vision 2030 structuring by the National Development Plans every five year and several other interventions. One such intervention is the TIPEEG (Targeted Intervention Programme for Employment and Economic Growth), which sought to promote labour intensive economic growth, increased income equality and to promote 'star' industries for expansion and employment creation. For example, during the NDP4 period, the following economic sectors will enjoy priority status, logistics, tourism, manufacturing and agriculture (NSA, 2012).

Therefore, using household survey 2012 (Namibia Household Income and Expenditure Survey (NHIES) (2012)) data, this paper attempted to analyze the factors influencing for per capita income using hybrid cob-Douglas production function on identification of factors influencing on household per capita income (that includes the explanatory factors that may include immigration, gender equality, age and education). In addition to this factors that influencing income equality using Principal Component Analysis (PCA).

## 2. Namibia Demographic and household characteristic factors

Table 1 to 4 present the gender, residence, employment status and level education respectively. Gender distribution in Namibia shows 52.4% and 47.6% between female and male respectively ((Namibia Statistics Agency, 2012).

In the year 2000, Namibia's had an estimated population about 1,890,000 people, in year 2012 the population grown by 9.33% over 10 years, at an average growth rate of less than 0.93% annual growth (NSA, 2012).

Unemployment on an averages stands at about 30% of the labour force (NSA, 2012). As shown in Table 1 there are roughly equal numbers of males and females, although the proportion of females appears to have increased slightly over the past 40 years from about 49% to 53% in 2000, whereas in 2012 becomes 52% and 48% respectively (NSA, 2012).

**Table 1: Gender distribution in Namibia**

|         | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------|-----------|---------|---------------|--------------------|
| Female  | 1083347   | 52.4    | 52.4          | 52.4               |
| Male    | 982836    | 47.6    | 47.6          | 100.0              |
| Missing | 215       | 0.0     | 0.0           | 100.0              |
| Total   | 2066398   | 100.0   | 100.0         |                    |

Own computation using Namibia Statistics Agency (2013). Namibia Household Income and Expenditure Survey (NHIES) (2012). Windhoek, Namibia

With regards to the residence distribution, there is a good deal of migration in Namibia, both by people entering the country and by people moving from rural to urban areas. Accurate figures on

the numbers of immigrants are not available, but it is clear that many people have moved into northern Namibia - especially from Angola where they add significantly to the population that has to be served by the health services (NSA, 2012).

**Table 2: Distribution of residence (urban& rural area)**

|       | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|-----------|---------|---------------|--------------------|
| Rural | 1282837   | 62.1    | 62.1          | 62.1               |
| Urban | 783561    | 37.9    | 37.9          | 100.0              |
| Total | 2066398   | 100.0   | 100.0         |                    |

Own computation using Namibia Statistics Agency (2013). Namibia Household Income and Expenditure Survey (NHIES) (2012). Windhoek, Namibia

Table 3 presents Namibia population with regards to regional distribution, the highest population Khomas region (which constitute capital city of Windhoek) represent about 16.5 percent, followed by Kavango, Ohangwena and Omusati about population of 13.7%, 11.5% and 11.4% respectively (see Table 3). (NSA, 2012).

**Table 3: Namibia population regional distribution**

|              | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------|-----------|---------|---------------|--------------------|
| Caprivi      | 100309    | 4.9     | 4.9           | 4.9                |
| Erongo       | 138139    | 6.7     | 6.7           | 11.5               |
| Hardap       | 67449     | 3.3     | 3.3           | 14.8               |
| Karas        | 77863     | 3.8     | 3.8           | 18.6               |
| Kavango      | 283815    | 13.7    | 13.7          | 32.3               |
| Khomas       | 339934    | 16.5    | 16.5          | 48.8               |
| Kunene       | 74628     | 3.6     | 3.6           | 52.4               |
| Ohangwena    | 238325    | 11.5    | 11.5          | 63.9               |
| Omaheke      | 62892     | 3.0     | 3.0           | 66.9               |
| Omusati      | 235417    | 11.4    | 11.4          | 78.3               |
| Oshana       | 170974    | 8.3     | 8.3           | 86.6               |
| Oshikoto     | 161665    | 7.8     | 7.8           | 94.4               |
| Otjozondjupa | 114988    | 5.6     | 5.6           | 100.0              |
| Total        | 2066398   | 100.0   | 100.0         |                    |

Own computation using Namibia Statistics Agency (2013). Namibia Household Income and Expenditure Survey (NHIES) (2012). Windhoek, Namibia

In 2000 Namibian labour force of which 80 percent are employed, 53 percent are males and 47 percent are females. The most common occupations in Namibia is that of skilled agricultural and fishery workers (25 percent); elementary occupation (20 percent) and craft and trade workers (14 percent); compared to 2012 which accounted for 15.50 percent, agriculture, forestry, hunting and fishing employed about 9.5 percent (see appendix 1).

92 **Table 4: Distribution of employment status of Namibia**

|                | Frequency | Percent | Valid Percent | Cumulative Percent |
|----------------|-----------|---------|---------------|--------------------|
| Employed       | 617696    | 29.9    | 29.9          | 29.9               |
| Unemployed     | 318880    | 15.4    | 15.4          | 45.3               |
| Not applicable | 1123316   | 54.4    | 54.4          | 99.7               |
| Not stated     | 6506      | 0.30    | 0.30          | 100.0              |
| Total          | 2066398   | 100.0   | 100.0         |                    |

93 Own computation using Namibia Statistics Agency (2013). Namibia Household Income and Expenditure  
94 Survey (NHIES) (2012). Windhoek, Namibia

95  
96 Table 5 shows the educational level of Namibia; primary and secondary present about 32.9% and  
97 32.8% respectively, tertiary about 4% only; whereas no formal education accounted for about  
98 28.7%, this shows clearly that the need for educational capacity development intensification, but  
99 should be demand driven (NSA, 2012)..

100

**Table 5: Namibia Level of education**

|                     | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------------------|-----------|---------|---------------|--------------------|
| No formal education | 592381    | 28.7    | 28.7          | 28.7               |
| Primary             | 680488    | 32.9    | 32.9          | 61.6               |
| Secondary           | 677111    | 32.8    | 32.8          | 94.4               |
| Tertiary            | 82702     | 4.0     | 4.0           | 98.4               |
| Not stated          | 33717     | 1.6     | 1.6           | 100.0              |
| Total               | 2066398   | 100.0   | 100.0         |                    |

101 Own computation using Namibia Statistics Agency (2013). Namibia Household Income and Expenditure  
102 Survey (NHIES) (2012). Windhoek, Namibia

103

### 104 **3. FACTORS INFLUENCING INCOME INEQUALITY**

105 Evidence of income inequality has caused a wide-ranging discussion about the factors affecting  
106 inequality. Studies on both the transition and developed countries propose many factors that  
107 influence income inequality to a smaller or larger degree. The direction of these influences,  
108 however, is often unclear: whether a higher value of a certain factor causes higher or lower  
109 inequality depends on the characteristics of the economic system and the overall level of  
110 development of the country in question (see, for example, Cornia and Kiiski, 2001). However,  
111 Kaasa (2003) factors influencing income inequalities summarised into five categories, as  
112 presented below.

113 **Economic growth and the overall development level of a country:** this group includes growth  
114 in the GDP, technological progress and the structure of the economy, which may include the  
115 shares of the agricultural, industrial and service sectors. Higgins and Williamson (1999) cited in  
116 Kaasa (2003) reported that inverted U-shaped relationship between the average income and

income inequality; this concept was first introduced by Kuznets (Ferreira, 1999): growth from the low development level leads at to an increasing in inequality, but eventually higher development level decreases inequality. However, this theory was criticized by Gustafsson and Johansson (1997) cited in Kaasa (2003) , the direction of the economy dictated by the particular country's choice and level of development. There is evidence that if a large part of the population moves to a higher sector (for example, from agriculture into the industrial sector), inequality will increase, but if the movement stops, income distribution will become more (Gustafsson and Johansson, 1997) cited in Kaasa (2003).

Technological change can also be the cause of dispersion of wages, due the fact that increase in skilled workers and rising productivity of skilled workers only (Snower, 1999) cited in Kaasa (2003). However, these changes can be avoided with appropriate adjustments in education policy (Cornia and Kiiski, 2001).

In addition to these, there are many other factor influencing income inequality, that includes availability of natural resources. Countries well-endowed with natural resources tend to have greater inequality because of capital-based technology and a lower need for unskilled labour (Cornia and Kiiski, 2001).

**Macroeconomic factors:** inflation and unemployment, the size of government's expenditure, external debt and foreign reserves, changes in the exchange rate, and other economic factors are the cause of income inequality. High inflation mainly causes deepening inequality, because it redistributes resources from persons with fixed nominal income, usually from the socially less insured and poorer part of the population. However, by a progressive tax system, inflation can reduce the income share of the more affluent part of the population (Cornia and Kiiski, 2001).

**Demographic factors:** include processes of demographic development, including the age structure of population (share of economically active population), the growth and density of population; urbanisation, level of human capital, including the level of education and health condition of population. The level of human capital and especially education is of great importance, too (Eicher et al., 2000), (Bouillon, et al., 1999 cited in Kaasa (2003)). Research has indicated that the relationship between educational expansion and inequality is inverted U-shaped. During the initial phases of development, a rise in the population's level of education increases inequality, because more highly educated employees earn higher income. A further rise and equalisation in the educational level equalise the income distribution and bring about a decline in inequality (Cornia and Kiiski, 2001).

**Political factors:** include privatisation and the share of the private sector, level of taxes and the share of the public sector, openness of a country, especially trade openness and freedom of labour movement; social policy and other decisions of economic policy (Durham, 1999) cited in Kaasa (2003). .

**Historical, cultural and natural factors:** which among others include distribution of land ownership, people's attitude to inequality, extent of shadow economy, which are all formed in the course of long history (Cornia and Kiiski, 2001).

The empirical framework used to assess the influence of economic geography determinants is the Solow (1956) cited in Kaasa (2003) model augmented with human capital. The model has been widely used in the empirical growth literature, owing largely to its simplicity and flexibility. For

instance, despite being derived from a specific framework, the empirical version of model is sufficiently general to be consistent with some endogenous growth models (Arnold et al., 2007) cited in Kaasa (2003).

The Solow model has been widely used as a theoretical framework to explain differences across countries in income levels and growth patterns. The model is based on a simple production function with constant returns-to-scale technology. In the augmented version of the model (Mankiw, Romer and Weil, 1992) cited in Kaasa (2003), output is a function of human and physical capital, as well as labour (working-age population) and the level of technology.

Under a number of assumptions about the evolution of factors of production over time, the model can be solved for its long-run (steady-state) equilibrium whereby the path of output per capita is determined by the rates of investment in physical and human capital, the level of technology, and the growth rate of population. In the steady-state, the growth of GDP per capita is driven solely by technology, which is assumed to grow at a (constant) rate set exogenously in the basic model (Kaasa, 2003).

As it has been presented in the above, there is a complex set of factors affecting income inequality in a country. The extensive literature about this topic also includes many empirical studies focused on correlations between single factors and inequality. To get an idea about how the income inequality level of a country is formed, it is necessary to analyse many possible factors. However, only a few studies have taken into account all or many of these factors in regression analysis (Gustafsson and Johansson, 1997, Higgins and Williamson, 1999) cited in Kaasa (2003). One reason for this may be the problems arising when a large number of factors are analysed. Such analysis requires a large data set with many indicators, which often leads to the problem of multicollinearity. So it is very complicated to find an estimate for the influence of every single factor on income inequality and even if found it could be insignificant.

In this study two methodological approaches applied, to examine factors influencing per capita income hybrid Cob-Douglas function was applied. Whereas to examine factors influencing income inequality PCA was applied.

#### 4. DATA AND METHODOLOGICAL APPLICATION

Hybrid Cob-Douglas production regression is a method for estimating the unknown parameters in a linear regression model, with the goal of minimizing the differences between the observed responses in some arbitrary dataset and the responses predicted by the linear approximation of the data (visually this is seen as the sum of the vertical distances between each data point in the set and the corresponding point on the regression line - the smaller the differences, the better the model fits the data). The resulting estimator can be expressed by a simple formula, especially in the case of a single regressor on the right-hand side (Miller, 2008).

PCA is a traditional multivariate statistical method commonly used to reduce the number of predictive variables and solve the multi-collinearity problem (Bair et al. 2013). Principal component analysis looks for a few linear combinations of the variables that can be used to summarize the data without losing information in the process. This method of dimension reduction is also known as “parsimonious summarization” (Rosipal and Krämer 2006) of the data

200 Following Miller (2008) study the following present the simplified form of the model:

$$201 \quad \text{PCI} = G + A + \text{IM} + \text{ED} + A^2 \dots\dots\dots(1)$$

203 Where, PCCI, G, A & Ed represent Per Capita Income; Gender, Immigration (rural to urban) and  
204 education respectively.

205 To measure the magnitude and extent of elasticity of the estimated coefficient, it was necessary  
206 conduction to transform the model to log-linear and in the multiplicative forms as follows:

$$207 \quad \text{LnPCI} = \text{LnG} + \text{LnA} + \text{Ln IM} + \text{Ln IM} + \text{Ln ED} + 2 \text{Ln A} \dots\dots\dots(2)$$

208 From Namibia Statistics Agency (2013), using data collected for. Namibia Household Income and  
209 Expenditure Survey (NHIES) (2012) was the main source of data.

210 The PCA is computed by determining the eigenvectors and eigenvalues of the covariance matrix.  
211 The covariance matrix is used to measure how much the dimensions vary from the mean with  
212 respect to each other. The covariance of two random variables (dimensions) is their tendency to  
213 vary together as (Jeong, et al, undated)

$$\text{Cov} (X, Y) = E[E[X] - X].E[Y] - Y] \dots\dots\dots(3)$$

214 Where E[X] and E[Y ] denote the expected value of X and Y respectively. For a sampled dataset,  
215 this can be explicitly written out.

$$\text{Cov} (X, Y) = \sum_{i=1}^N \frac{(X_i - \bar{X})(Y_i - \bar{Y})}{N} \dots\dots\dots(4)$$

216  
217 With  $\bar{X}$  = mean (X) and  $\bar{Y}$  = mean (Y) where N is the dimension of the dataset. The  
218 covariance matrix is a matrix A with elements  $A_{i,j} = \text{cov}(i, j)$  It centers the data by  
219 subtracting the mean of each sample vector (Jeong, et al, undated).

220 In principal component analysis, the following important points are very important to follow to  
221 estimate best efficient and reliable interpretations (Jeong, et al, undated).

- 222 i. Kaiser-Meyer-Olkin measure of sampling adequacy: This measure varies between 0 and  
223 1, and values closer to 1 are better. A value of 0.6 is a suggested minimum.
- 224 ii. Bartlett's test of sphericity - This tests the null hypothesis that the correlation matrix is an  
225 identity matrix. An identity matrix is matrix in which all of the diagonal elements are 1  
226 and all off diagonal elements are 0. You want to reject this null hypothesis.
- 227 iii. Communalities: this is the proportion of each variable's variance that can be explained by  
228 the principal components. It can be defined as the sum of squared factor loadings, more  
229 than 0.40 is acceptable otherwise need to be removed from the analysis.

- iv. Initial Eigenvalues: by definition, the initial value of the communality in a principal components analysis more than 1, which explain the variation very well

## 5. RESULTS & DISCUSSIONS

### 5.1 HYBRID COBB-DOUGLAS ESTIMATION

For the basic assumption of parametric regression model suitability or assumption requirement (i) linearity the ANOVA shows it is significant at one percent, (ii) normality - the histogram shows it is normally distributed (see appendix), (iii) collinearity test indicated by "Tolerance" and "VIF", this two test predicate for each predictor that able to check multicollinearity. The "tolerance" is an indication of the percent of variance in the predictor that cannot be accounted for by the other predictors, hence very small values indicate that a predictor is redundant, and values that are less than 0.10 may merit further investigation. The VIF, which stands for variance inflation factor, is  $(1 / \text{tolerance})$  and as a rule of thumb, a variable whose VIF values is greater than 10 may merit further investigation (see table 6 ). However, Table 6 presents factors influencing for the household per capita income. The estimated coefficient all variables identified for this model found to be highly significant at one percent in all cases and positively related to influence household income per person (with the exception age square is negative estimated coefficient, as expected). Age squared captures the law of diminishing return that is an older person expected to reduce the employability chance.

Constant (error term) that includes other factors which are not captured in the model explain with higher magnitude, as the estimated coefficient is highly elastic. As it has been indicated the income inequality in literature review the direction and influences are multitude; for example Cornia and Kiiski (2001) and Kaasa (2003) factors influencing income inequalities summarized into five categories. However, out of those factors this study examining only the demographic characteristics, as error term shows it is significant at one present with estimated coefficient at 8.12, implying other unexplained factors have bigger influence to influence per capita income person in Namibia.

Immigration from rural to urban are among the main factors to influence income per person, it is significant, however, it is inelastic that implying that one percent increase in rural to urban immigration leads to increase income per person by 0.75 percent.

Classical Two-Sector Model by Adam Smith (1776) cited in Taylor and Martin (undated), shows that during industrial revolution land scarcity, and enclosure—that is, “supply push” variables—drove rural-to-urban migration. Others pointed to “demand-pull” variables, including the rapid development of manufacturing that fed population growth and urban poverty, this dynamic eventually cause elastic and inelastic behavior respectively. In addition to this within the context in the classical model theory Taylor and Martin (undated) study shows that migration demand-driven would perfectly elastic from farm labor to nonfarm jobs.

However, since immigration in Namibia mainly by supply push, due poor farm productivity and limitation of opportunity at the rural areas, this cause lost-labor, and possibly lost-capital, effects on rural economies. The implication of this would be (i) it is by nature it is inelastic migration due the fact it is “supply driven”(ii) implying the lost agricultural product of the migrant who secures an urban job does not represent the full opportunity cost of rural out-migration if more than one rural worker is induced to migrate. The opportunity cost for the rural sector also

includes the loss of agricultural production of others. As shown in Table 6 immigration estimated coefficient shows it is inelastic with estimated coefficient at only 0.75.

**Table 6: Hybrid Cobb-Douglas & OLS estimation**

| Model                | Unstandardized Coefficients |            | Standardized Coefficients | t       | Sig. | Collinearity Statistics |           |
|----------------------|-----------------------------|------------|---------------------------|---------|------|-------------------------|-----------|
|                      | B                           | Std. Error | Beta                      |         |      | Tolerance               | VIF       |
| (Constant)           | 8.121                       | 0.002      |                           | 3314.65 | 0.00 |                         |           |
| Immigration          | 0.747                       | 0.001      | 0.37                      | 577.56  | 0.00 | 0.94                    | 1.07      |
| Sex/Gender           | 0.062                       | 0.001      | 0.03                      | 51.32   | 0.00 | 0.99                    | 1.00      |
| Age groupings        | 0.013                       | 0.000      | 0.058                     | 63.53   | 0.00 | 0.47                    | 2.12      |
| Education            | 0.226                       | 0.001      | 0.22                      | 324.44  | 0.00 | 0.85                    | 1.18      |
| AGESQ                | -0.000                      | 0.000      | -0.03                     | -35.06  | 0.00 | 0.50                    | 1.99      |
| <b>Model Summary</b> |                             |            |                           |         |      |                         |           |
| R. Square            |                             |            |                           |         |      |                         | 0.48      |
| Adj R.Square         |                             |            |                           |         |      |                         | 0.33      |
| ANOVA <sup>a</sup>   |                             |            |                           |         |      |                         | 0.000     |
| F-statistics         |                             |            |                           |         |      |                         | 15 045    |
| Observation          |                             |            |                           |         |      |                         | 2,066,398 |

a. Dependent Variable: HHLG

b. Predictors: (Constant), Level of education, Sex/Gender, Age groupings, Urban/Rural area

Source: own computation

The positive and reciprocal relationship between gender equality and economic well documented in international development agencies; specifically on policy discussions. For example, World Bank Report recommends fostering economic development as a means of promoting gender equality, claiming that “rising income and falling poverty levels tend to reduce gender disparities in education, health, and nutrition.” (World Bank, 2001). Gender equality in this study shows it is relatively smaller estimated coefficient at 0.062, this implying that still is not significant effect to influence the income per capita in Namibia. For example report from NSA (2012) shows that the disparities in income, employment, and access to resources in Namibia there is disparity. Females experience somewhat higher unemployment rate than males, 39 per cent and 28 percent respectively when the broad measure of unemployment is used. When the strict definition of unemployment is used, the unemployment rate of females remains higher than that of males 22 per cent and 19 percent respectively

Unemployment amongst women is higher in both rural and urban areas (52.8% and 35.7%) compared to men (41% and 25.8%). Of the economically inactive section of the Namibian population, 14.9% are classified as homemakers, with women accounting for the vast majority (NSA, 2012). Women are the bulk of caregivers, yet are considerably under-represented in the formal economy, especially the managerial level (NSA, 2013). Female-headed households, which are some 40% of the total, have a per capita income of US\$630, in contrast to male-headed households with a per capita income of US\$ 1100 (at April-2015 exchange rate). These figures point to a large number of single mothers and to the continued economic marginalization of women in Namibian society (NSA, 2012).

The influence of education in this model estimated relatively bigger compared to the other variables in the probability of higher income per person, this clearly link to the hypothesis of the higher educated there is higher chance of employability, As show Table 5 shows the educational

level of Namibia; primary and secondary present about 32.9% and 32.8% respectively, tertiary about 4% only; whereas no formal education about 28.7%, this shows clearly, the need for Namibia for capacity development intensification.

## 5.2 PRINCIPLE COMPONENT ANALYSIS

In this study attempting were made to include more variables to major factors influence income equality, as primarily the technique is a traditional multivariate statistical method commonly used to reduce the number of predictive variables and solve the multi-colinearity problem (Bair et al. 2006). Principal component analysis looks for a few linear combinations of the variables that can be used to summarize the data without losing too much information in the process. This method of dimension reduction is also known as “parsimonious summarization” (Rosipal and Krämer, 1989 cited in Maitra and Yan, 2008) of the data. Table 7 shows the description of explanatory variable include that influence income equality in Namibia.

**Table 7: Descriptive Statistics**

|                           | Mean   | Std. Deviation | Analysis N | Missing N |
|---------------------------|--------|----------------|------------|-----------|
| Economic activity         | 82.52  | 30.707         | 2066398    | 0         |
| Age groupings             | 5.5705 | 4.46560        | 2066398    | 0         |
| Level of education        | 2.1700 | .94466         | 2066398    | 0         |
| Urban/Rural area          | .38    | .485           | 2066398    | 0         |
| marital status            | 4.98   | 1.796          | 2066398    | 0         |
| Literacy                  | 2.27   | 2.545          | 2066398    | 0         |
| Occupation                | 87.45  | 20.809         | 2066398    | 0         |
| Economic activity grouped | 71.38  | 41.397         | 2066398    | 0         |

Source: own computation

Table 8 shows the extraction process of loading explain the variation of the income equality adequately, as the output result shows more than 50% of each variable.

**Table 8: Communalities**

|                           | Initial | Extraction |
|---------------------------|---------|------------|
| Economic activity         | 1.000   | .795       |
| Age groupings             | 1.000   | .721       |
| Level of education        | 1.000   | .731       |
| Urban/Rural area          | 1.000   | .615       |
| marital status            | 1.000   | .574       |
| Literacy                  | 1.000   | .680       |
| Occupation                | 1.000   | .753       |
| Economic activity grouped | 1.000   | .924       |

Extraction Method: Principal Component Analysis.

Source: own computation

Table 9 dissipate two important interpretations of PCA, Eigenvalues are the variances of the principal components. Since the components 1 to 3 explain best for the variation of income equality in Namibia, in total those three components explain about 72%.

**Table 9: Total Variance Explained**

| Component                                        | Initial Eigenvalues |               |              | Extraction Sums of Squared Loadings |               |              |
|--------------------------------------------------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|
|                                                  | Total               | % of Variance | Cumulative % | Total                               | % of Variance | Cumulative % |
| 1                                                | 3.338               | 41.722        | 41.722       | 3.338                               | 41.722        | 41.722       |
| 2                                                | 1.354               | 16.923        | 58.645       | 1.354                               | 16.923        | 58.645       |
| 3                                                | 1.101               | 13.756        | 72.401       | 1.101                               | 13.756        | 72.401       |
| 4                                                | .882                | 11.021        | 83.422       |                                     |               |              |
| 5                                                | .516                | 6.448         | 89.870       |                                     |               |              |
| 6                                                | .392                | 4.904         | 94.774       |                                     |               |              |
| 7                                                | .312                | 3.900         | 98.675       |                                     |               |              |
| 8                                                | .106                | 1.325         | 100.000      |                                     |               |              |
| Extraction Method: Principal Component Analysis. |                     |               |              |                                     |               |              |

Source: own computation

Table 10 shows the structure of possible component matrix explains for income equality in Namibia. In first component the age structure and level of education explain negatively the income equality in Namibia; the result coincide with econometric outputs, that is the probability of higher education will lead to income equality; however, the age structure implying that the younger the citizen will have employability probability. Whereas, Economic activity (that might provide opportunity for employability), level of education, marital status, Literacy and Occupation comes out as positive influencers for income equality.

In second component Economic activity and rural to urban immigration influence positively, whereas literacy rate becomes negatively. Whereas, in the third component the age structure becomes negative which is consistent with component, but immigration and marital status becomes positive.

**Table 10: Component Matrix<sup>a</sup>**

|                    | Component |       |        |
|--------------------|-----------|-------|--------|
|                    | 1         | 2     | 3      |
| Economic activity  | 0.730     | 0.502 |        |
| Age groupings      | -0.614    |       | -0.564 |
| Level of education | -0.550    | 0.631 |        |
| Urban/Rural area   |           | 0.427 | 0.634  |

|                                                  |       |        |       |
|--------------------------------------------------|-------|--------|-------|
| marital status                                   | 0.632 |        | 0.417 |
| Literacy                                         | 0.567 | -0.572 |       |
| Occupation                                       | 0.790 |        |       |
| Economic activity grouped                        | 0.866 | 0.349  |       |
| Extraction Method: Principal Component Analysis, |       |        |       |
| a. 3 components extracted.                       |       |        |       |

Source: own computation

## 6 CONCLUSIONS AND POLICY IMPLICATIONS

This paper aim was to attempt to analyze the factors influencing for per capita income using hybrid cob-Douglas production function; whereas for factors influence income inequality PCA was applied.

Hybrid Cob Douglas production function econometric analysis shows that factors that includes immigration, gender equality, age and education found to be positively and significant at one percent to explain the household income per person, as expected. However, labour immigration is more driven by supply pus, rather than demand pull, as a result was all factors found to be inelastic, that implying that cause higher income disparity and agriculture farm productivity and capital lost for the rural areas.

PCA found that three components extracted to explain best for the variation of income equality in Namibia, in total it was estimated at about 72%.

Because each of urban jobs stimulates the migration would be more than one rural worker, eventually leads the average income per capita becomes not significant to change. Furthermore the opportunity cost of urban job creation for the rural economy is larger than would be the case in a context of urban full employment. Therefore, it is necessary government and donor agencies to focus on wide production efficiency and other support service (that may include tax and subsidy schemes).

The result of this paper shows that Namibia does not seem to break the cyclical problem of poverty, unemployment and filling the required skill for better economic growth. Although the above mentioned problems are socio-economic problems, however require for strong political leadership and will with private and public partnership. In Namibia unemployment seems to be of a structural nature as a result of the mismatch between skills and the requirements of the job opportunities. Structural unemployment is long-lived and is not sensitive to changes in aggregate demand.

The above identified variables that influence income per person that was applied on regression and PCA that influence income equality mainly caused by structural factors such as skilled deficit and the nature of the educational system itself (which mainly focusing on supply driven). Understanding the linkages between poverty, inequality and economic growth and identification of existing options to bridge the gap between rich and poor are key public policy challenges, which require further research on the area.

362 **References**

- 363 Bair E, Trevor H, Paul D, Robert T (2006). Prediction by Supervised Principal Components,  
364 *Journal of the American Statistical Association* 101, no. 473, 2006, pp. 119-137(19).
- 365 Cornia G A., Kiiski S (2001). Trends in Income Distribution in the Post- World War II Period.  
366 *UNU/WIDER Discussion Paper* No. 2001/89, Sept. 2001
- 367 Eicher T., Garcia P C (2000). Inequality and growth: The dual role of human capital in  
368 development. *CESifo Working Paper* No. 355, Nov. 2000.
- 369 Ferreira, F. H. G (1999). Inequality an Economic Performance. A Brief Overview to Theories of  
370 Growth and Distribution.’ — *World Bank*, June 1999,  
371 [<http://www.worldbank.org/poverty/inequal/econ/>], 25/04/2015.
- 372 International Monetary Fund (IMF) (2011) ‘2011 Article IV Consultation’. IMF Country Report  
373 No. 12/41, IMF.
- 374 Jauch H (2012). Poverty, Unemployment and Inequality in Namibia, August 2012. Accessible  
375 <http://vivaworkers.org/wp-content/uploads/2013/02/Poverty-unemployment-inequality-2012.pdf>  
376 [25-April-2015]
- 377 Jeong DH, Ziemkiewicz, C, Ribarsky W, Chang (undated). Understanding Principal  
378 Component Analysis Using a Visual Analytics Tool. Accessible on  
379 [http://www.purdue.edu/discoverypark/vaccine/assets/pdfs/publications/pdf/Understanding%20Pr](http://www.purdue.edu/discoverypark/vaccine/assets/pdfs/publications/pdf/Understanding%20Principal%20Component.pdf)  
380 [incipal%20Component.pdf](http://www.purdue.edu/discoverypark/vaccine/assets/pdfs/publications/pdf/Understanding%20Principal%20Component.pdf) accessed on 27/04/2015
- 381 Kaasa A (2003). Factors influencing income inequality in transition Economies, University of  
382 Tartu Faculty of Economics and Business Administration
- 383 Levine S (2006). Measuring progress towards global poverty goals: Challenges and lessons from  
384 Southern Africa. *UNDP MPRA Paper* No. 4932.
- 385 Maitra S, Yan J (2008). Casualty Actuarial Society, 2008 Discussion Paper Program . available  
386 on [https://www.google.com.na/?gws\\_rd=cr,ssl&ei=ZA4-VfX3HcONsAGVyIGICQ#](https://www.google.com.na/?gws_rd=cr,ssl&ei=ZA4-VfX3HcONsAGVyIGICQ#) accessed  
387 27/4/2015
- 388 Mastert R, Brown B, Conradue J (2014). Namibian Economic Outlook 2014. IIG –Securities  
389 (Pty)ltd report, Windhoek, Namibia
- 390 Miller E (2008). An Assessment of CES and Cobb-Douglas Production Functions. Congressional  
391 Budget Office. [https://www.google.com.na/?gws\\_rd=cr,ssl&ei=KP89VcvICsSLsAHaz4CwBA#](https://www.google.com.na/?gws_rd=cr,ssl&ei=KP89VcvICsSLsAHaz4CwBA#)  
392 accessed on 15/04/2015
- 393 Namibia Statistics Agency (2012). National Accounts time series 1980-2012. Namibia Statistics  
394 Agency, Windhoek.
- 395 Namibia Statistics Agency (2013). The Namibia Labour Force Survey 2012 Report. Windhoek,  
396 Namibia

- 397 Rosipal R, Nicole K (2006) Overview and Recent Advances in Partial Least Squares, in  
398 Subspace, Latent Structure and Feature Selection, Saunders, C., et al. (eds.) (Heidelberg:  
399 Springer-Verlag, 2006) vol. 3940, pp. 34-51.
- 400 Taylor JE, Martin PI (undated). Human Capital: Migration and Rural Population Change .  
401 Chapter for Handbook of Agricultural Economics, Bruce L. Gardner and Gordon C. Rausser,  
402 eds., to be published by Elsevier Science, New York. Accessible  
403 [https://www.google.com.na/?gws\\_rd=cr,ssl&ei=ZA4-VfX3HcONsAGVyIGICQ#](https://www.google.com.na/?gws_rd=cr,ssl&ei=ZA4-VfX3HcONsAGVyIGICQ#) accessed on  
404 27/04/2015
- 405 World Bank. (2001). *Engendering Development Through Gender Equality in Rights, Resources,*  
406 *and Voice*. Oxford University Press, New York
- 407

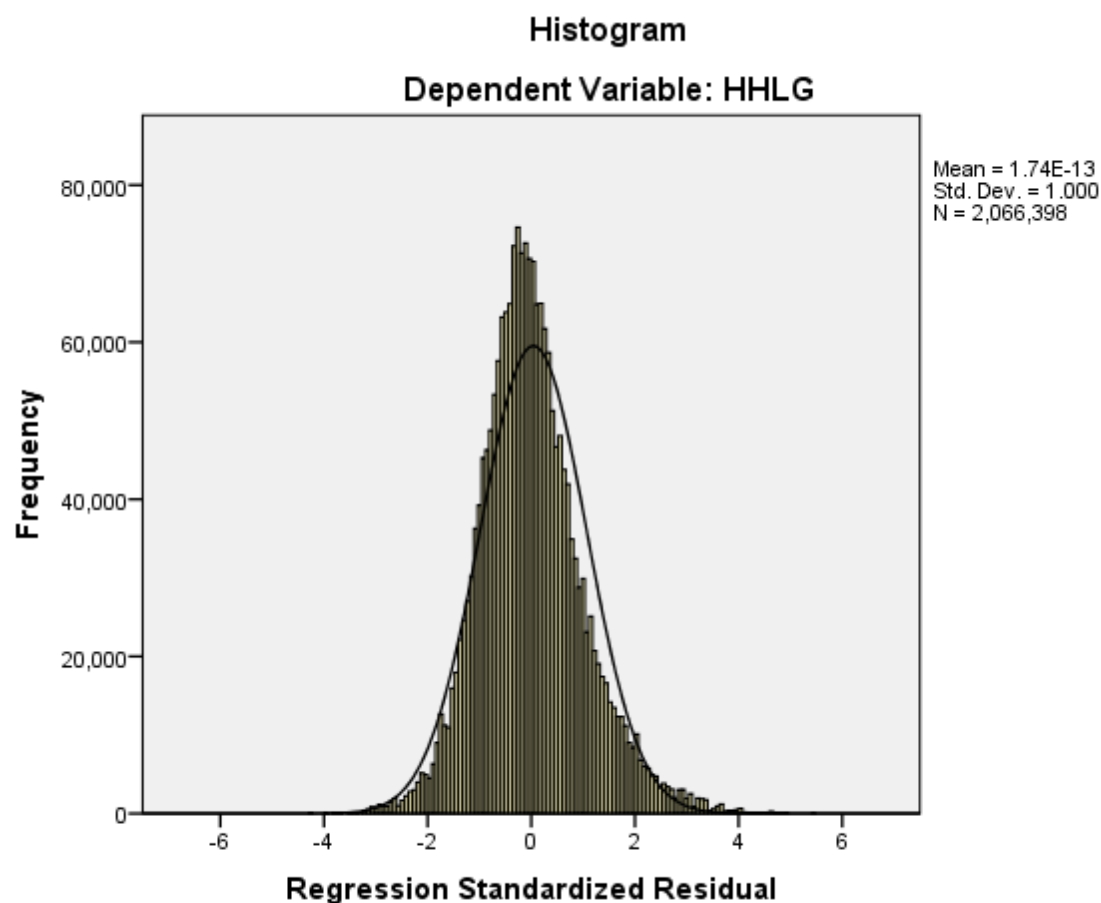
## Appendix 1: Economic activity grouped

|                                                              | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------------------------------------------------------------|-----------|---------|---------------|--------------------|
| Agriculture, forestry and hunting                            | 183196    | 8.9     | 8.9           | 8.9                |
| Fishing                                                      | 13482     | 0.7     | 0.7           | 9.5                |
| Mining and quarrying                                         | 10249     | 0.5     | 0.5           | 10.0               |
| Manufacturing                                                | 29237     | 1.4     | 1.4           | 11.4               |
| Electricity, gas and water supply                            | 3756      | 0.2     | 0.2           | 11.6               |
| Construction                                                 | 32761     | 1.6     | 1.6           | 13.2               |
| Wholesale and retail trade, repair of motor vehicles and mot | 49816     | 2.4     | 2.4           | 15.6               |
| Hotels and restaurants                                       | 16360     | 0.8     | 0.8           | 16.4               |
| Transports, storage and communications                       | 19109     | 0.9     | 0.9           | 17.3               |
| Financial intermediation                                     | 8046      | 0.4     | 0.4           | 17.7               |
| Real estate, renting and business activities                 | 71728     | 3.5     | 3.5           | 21.2               |
| Public administration and defense                            | 46954     | 2.3     | 2.3           | 23.5               |
| Education                                                    | 36146     | 1.7     | 1.7           | 25.2               |
| Health and social work                                       | 16828     | 0.8     | 0.8           | 26.0               |
| Other communal, social and personal service activities       | 18300     | 0.9     | 0.9           | 26.9               |
| Private households with employed persons                     | 48796     | 2.4     | 2.4           | 29.3               |
| Extra-territorial organizations and bodies                   | 2182      | 0.1     | 0.1           | 29.4               |
| Not applicable                                               | 1448641   | 70.1    | 70.1          | 99.5               |

|            |         |       |       |       |
|------------|---------|-------|-------|-------|
| Not stated | 10810   | 0.5   | 0.5   | 100.0 |
| Total      | 2066398 | 100.0 | 100.0 |       |

Source: Namibia Statistics Agency (2013). Namibia Household Income and Expenditure Survey (NHIES) (2012). Windhoek, Namibia

## Appendix 2: Normality distribution of LN of the household per capita income



Cases weighted by Raising factor (Weights)

Source: own computation

## Appendix : basic economic indicators for Namibia

| Basic Indicators                      |  |  | 2012         |
|---------------------------------------|--|--|--------------|
| Population size                       |  |  | 2,085,927.00 |
| Female                                |  |  | 1,084,845.00 |
| Male                                  |  |  | 1,001,082.00 |
| <b>Population composition</b>         |  |  |              |
| Under 15 years                        |  |  | 770,265.00   |
| Working age 15 + years                |  |  | 1,315,662.00 |
| <b>Economically active population</b> |  |  |              |
| Employed                              |  |  | 630,094.00   |

|                                                |              |              |              |
|------------------------------------------------|--------------|--------------|--------------|
| Unemployed - broad                             |              |              | 238,174.00   |
| Labour force                                   |              |              | 868,268.00   |
| Labour force participation rate - broad        |              |              | 66.00        |
| Unemployment rate - broad                      |              |              | 27.40        |
| <b>Economically active population by sex</b>   |              |              |              |
| Female employed                                |              |              | 300,390.00   |
| Male employed                                  |              |              | 329,704.00   |
| Female unemployed - broad                      |              |              | 140,172.00   |
| Female unemployment rate - broad               |              |              | 31.80        |
| Male unemployed                                |              |              | 98,002.00    |
| Male unemployment rate - broad                 |              |              | 22.90        |
| Male labour force participation rate - broad   |              |              | 69.10        |
| Female labour force participation rate - broad |              |              | 63.20        |
| <b>Comparative economic indicators</b>         | <b>2004</b>  | <b>2008</b>  | <b>2012</b>  |
| Population 15 years and above                  | 1,024,110.00 | 1,106,854.00 | 1,315,662.00 |
| Labour force                                   | 493,448.00   | 678,680.00   | 868,268.00   |
| Employed population                            | 385,329.00   | 331,444.00   | 630,094.00   |
| Unemployed population - broad                  | 223,281.00   | 347,237.00   | 238,174.00   |
| Not economically active Population             | 530,662.00   | 428,174.00   | 404,122.00   |
| Unemployment rate - broad                      | 36.70        | 51.20        | 27.40        |
| Labour force participation rate                | 47.90        | 55.40        | 66.00        |

416 Source: Namibia Statistics Agency (2013). Namibia Household Income and Expenditure Survey  
 417 (NHIES) (2012). Windhoek, Namibia

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