

Analysis of subjective well-being by influence of marketing factors and pyrethrum farmers' characteristics in makete; Tanzania

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ABSTRACT

The study examined the influence of marketing factors, demographic, and socio-economic factors on the subjective well-being of the pyrethrum farmers in Makete district. The marketing factors examined are rural farm transport, technological type of drying facility and market stability. The demographic and socio-economic variables are age, sex, agricultural extension services, yearly average income, total size of land, number of household members, education level and occupation. The cross-sectional study design was employed and the Leyden approach of using satisfaction with life as a whole question developed by Van Praag (1968, 1971) was used. The results showed that marketing factors, demographic, and socio-economic variables had an influence on the subjective well-being of the pyrethrum farmers.

Keywords: *Subjective Well-Being, Marketing Factors, Demographic And Socio-Economic Factor*

Marketing of agricultural produce at rural primary marketing level is an imperative economic movement within the output phase (United Republic of Tanzania, 2011) and it is marketing which guarantees their produce to generate income which in turn would determine the economic well-being of the pyrethrum farmers (URT, 2011). Pyrethrum farmers in parts of the world, for example Africa, primarily East Africa in which some countries like Tanzania, tolerate severe pyrethrum marketing constraints due to the fact that, farmers fail to readily access marketing factors for effective and efficient marketing activities at rural primary marketing level. These circumstances cause shortfall to rural income and turn down their economic well-being. (URT, 2011). Previous literature documenting Easterlin Paradox (Easterlin 1974, 1995, 2005a, 2006 & 2009) has largely focused on life satisfaction questions. According to Diener (2006), the satisfaction question calls for respondents to assess the wholly of their well-being while more specific questions that stimulate in on affect measure feelings only. This study employed Leyden approach, a Dutch tradition of studying subjective economic welfare (Van Prang and Ferrer-i-Carbonell, 2004). Within this research tradition, measures of subjective poverty lines and income

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Received: October 28, 2020; Revision Received: December 20, 2020; Accepted: December 31, 2020

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evaluation have been developed. We attest these measures to the analysis of subjective well-being by the influence of marketing factors, demographic, and socio-economic factors on the subjective well-being of the pyrethrum farmers in Makete district. The marketing factors examined are rural farm transport, technological type of drying facility and market stability. The demographic and socio-economic variables are age, sex, agricultural extension services, yearly average income, total size of land, number of household members, education level and occupation.

Studies carried out on marketing factors came up with the following findings: Firstly, quality of farm products to a certain extent depends on how good transport is for the harvested crop (Abdi, 2004). Secondly, the type of drying facilities which is either of modern or traditional technology do affect the quality of farm product (Lybbert & Sumner, 2012). That is, with traditional drying facilities, there is always a possibility of contaminating pyrethrum flowers with dirty materials, dust and exposure to damages by domestic animals and poultry (USAID, 2012) but with modern facilities such as solar energy, shelves made of wire mesh and wood would provide conducive environment for drying raw pyrethrum white flowers in more safety conditions and reduce risk of contamination with dirty materials, dust and exposure to damages by domestic animals and poultry (UNIDO, 2000). In addition, modern facilities would improve both the quality of pyrethrum dried flowers and easing the drying process for pyrethrum farmers. Thirdly, there is the issue of market information flow deficiency. Due to lack of information, say, on price, farmers would likely sell their products at low prices that would in turn affect their well-being as well (Srinivasan, 2008; European Union, 2011). Fourthly, market stability is also another marketing factor. Good market stability would improve both effective and efficient marketing of their produce (PIDTF, 2011).

The objective of this study was to carry a further analysis of the influence of these marketing factors, but also including the demographic, and socio-economic variables on the subjective well-being of pyrethrum farmers in Makete district; Tanzania.

In this study, we use two concepts namely well-being and subjective well-being. Well-being stands for an overall life satisfaction or happiness of an individual (Van Praag, 1971). Well-being is considered as an umbrella concept embracing objective well-being and subjective well-being (Gough et al., 2007). Subjective well-being, abbreviated as SWB, refers to feelings of the person whose well-being is predictable in accord to its meaning, but allows a variety of related ideas and concepts to be included in its conceptualization (Gasper, 2008). In most of its meaning, subjective well-being is characteristically obtained by a questionnaire (Diener, 1984). This study analyzed subjective well-being by using influence of marketing factors and pyrethrum farmers' characteristics at rural primary marketing level by employing the ordered probit model.

Conceptual framework

Figure 1. shows the interlinking between the marketing factors and subjective well-being. Marketing factors are composed of rural farm transport, type of drying facilities, market information and market stability on one hand while the demographic and socio-economic variables are composed of age, sex education, occupation, number of household members, total size of cultivated land, yearly average income of the household heads and agricultural extension services on the other hand. Marketing factors, if rightly deployed, would enable households to sell their pyrethrum profitably. For instance, if there is good rural farm

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transport the farmers could be able to transport to their households and to market places, fresh and quality pyrethrum flowers after harvesting free of any spoilage. So also, good drying facilities could enable pyrethrum farmers to dry pyrethrum flowers effectively and efficiently obtaining quality dried pyrethrum flowers with high pyrethrin percentage which would fetch high prices. Consequently, this would lead to improved subjective well-being.

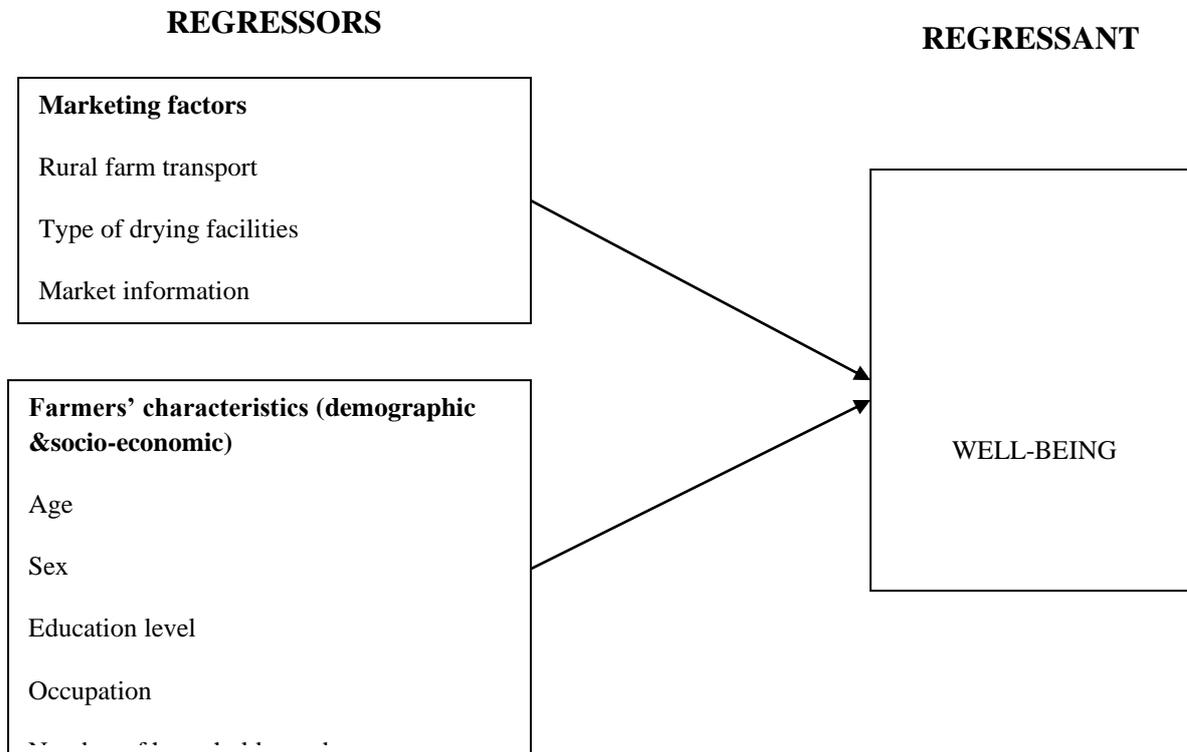


Figure 1. Conceptual framework

Source: Own construct

With regards to demographic variables, it is considered that an increase in age would increase the working capability of the farmers in pyrethrum fields and thus increasing the quantity of products. Larger quantities of quality produce would boost up household income leading to improved well-being. Regarding the socio-economic characteristics; it is expected that education level of the household head would influence household well-being in a way that the higher the level of education the better the well-being of the household. Likewise, number of household members is expected to influence the well-being of pyrethrum farmers in a way that, farmers with large number of household members might be of the advantage in having high labor force for the harvesting of the raw pyrethrum compared to the households with small number of household members which might lead to improving their well-being as well. Furthermore, the total size of land of farmers is expected to influence the well-being of pyrethrum farmers in a sense that the larger the total size of land of the farmers the higher the pyrethrum output which might increase the pyrethrum income sales and leading to improved well-being of farmers. Further, yearly average income of farmers is expected to influence their well-being in a way that farmers with high yearly average income might lead to improving their well-being compared to those farmers with low yearly average income.

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Occupation of farmers (private sector employee, government employee and business men or women), expected to influence their well-being in a way that farmers with any of the three occupation sectors might lead to improving their well-being compared to those farmers who are unemployed.

Agricultural extension services of farmers are expected to influence their well-being in a way that farmers who access easily the agricultural extension services from agricultural extension officers might lead to improving their well-being compared to pyrethrum farmers who could not easily access the agricultural extension services.

MATERIALS AND METHODS

This study employed cross-sectional research design. The pyrethrum farmers in Makete district, Njombe region were visited once to collect primary data in the year 2014. The unit of analysis was the household heads. We conducted research survey and structured questionnaires which were produced into two formal languages namely Kiswahili and English to avoid translation difficulties among the enumerators. We conducted study in the villages of Invilikingo, Isapulano, Ibagu, Kidope, Makwaranga, Matenga, Kinyika, Igumbilo and Ludilu. These villages are pyrethrum growing villages. The people inhabiting in these villages mostly depend on pyrethrum crop as the main traditional cash crop for their living. Majority of the pyrethrum farmers derive their well-being from pyrethrum sales. This study area has the volcanic soils due to the past volcano explosions in Livingstone Mountains. The area is located within altitude 1500 to 3000 meters above sea level and this makes the area experience temperate climatic conditions with low temperatures ranging from 2°C to 20°C in highlands where pyrethrum flowers are grown. In the lowlands with temperatures ranging between 20°C to 30°C pyrethrum flowers are not grown.

In this paper we used the Leyden Approach in the data analysis. The Leyden approach is a Dutch tradition of studying subjective welfare in connection with the economic circumstances of the household, for instance, income, family composition, age and employment (Van Praag and Ferrer-i-Carbonell, 2004). Within this research tradition, measures of subjective poverty lines and income evaluation have been developed. Leyden approach has been employed in this study to measure the subjective well-being of pyrethrum farmers by using respondents' responses on satisfaction-with-life as a whole question developed by Van Praag (1968, 1971) originating from Gurin et al. (1960). In this approach, there were five response choices: "Very dissatisfied" "1", "Dissatisfied" "2", "Uncertain" "3", "Satisfied" "4" and Very satisfied "5". Pyrethrum farmers were asked the following question:- How satisfied are you with the way the family lived after starting selling pyrethrum flowers? We denoted the responses obtained by v^i , on a (1, 5) scale taken as a proxy of an individuals' subjective well-being, given an abbreviation of SWB. Responses

$SWB_i^* = \alpha + \beta X_{ki} + \varepsilon$ from household head i were explained as shown in equation (1a):

$$SWB_i = v \Leftrightarrow \pi_v \leq SWB_i^* < \pi_{v+1} \tag{1a}$$

Where: SWB_i is the response to the satisfaction question, and SWB_i^* is an unobserved latent variable, i represented the pyrethrum farmer and v , the five discrete categories (1 to 5), π_v , two estimated intercept terms, known as "threshold parameters". The independent variables consist of marketing factors, that is, rural farm transport dummy, ($hhsacrtnD1$) and ($hhsacrtnD2$); technological type of drying facilities dummy, ($techdyfcD1$) and

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(techdyfcD2); market information dummy, (mktinfonD1), (mktinfonD2) and (mktinfonD3); market stability (mktstbltD1), (mktstbltD2) and (mktstbltD3); together with demographic variables and socio-economic characteristics of farmers that comprised of: natural logarithm of yearly average income of farmers, $\ln(yaitsh)$; natural logarithm of number of household members, $\ln(nhnm)$; natural logarithm of total size of land owned by farmers, $\ln(tszlowhh)$; natural logarithm of age of farmers, $\ln(age)$; sex dummy, $sexD$; educational level, dummy $eduD : (eduD1), (eduD2), (eduD3) \text{ and } (eduD4)$; Occupation of farmers' dummy, $occD : (occD1), (occD2), (occD3) \text{ and } (occD4)$; agricultural extension services dummy, $(aexservD1) \text{ and } (aexservD2)$; and ε which is a random disturbance error term. These variables were incorporated in the ordered probit model. Since we had no clear expectations on the number of household members' influence, as there might have been an optimal number of children in a pyrethrum farmer's household, thus we introduced a squared term, (natural logarithm of number of household members squared), $\ln(nhnm)^2$ and an interaction term was added between natural logarithm of yearly average income of farmer's household and number of household members $\ln(yaitsths) \text{ and } \ln(nhnm)$, in the equation (1b), as we kept on assuming that the optimal number of children varied with the financial situation of the pyrethrum farm households. This study continued on assuming that, well-being is age dependent, (natural logarithm of age and natural logarithm of age-squared), $\ln(age)$ and $\ln(age)^2$ also added in the model. Then, 28 study variables were introduced in the estimation model as shown in equation (1b).

$$\begin{aligned}
 SWB_i^* = & \beta_0 + \beta_1 \ln(nhnm) + \beta_2 (\ln nhnm)^2 + \beta_3 \ln(yaitsths) + \beta_4 (\ln yaitsths)^2 + \\
 & \beta_5 \ln(tszlowhh) + \beta_6 \ln(age) + \beta_7 (\ln age)^2 + \beta_8 (sexD) + \\
 & \beta_9 (eduD1) + \beta_{10} (eduD2) + \beta_{11} (eduD3) + \beta_{12} (eduD4) + \beta_{13} (occD1) + \\
 & \beta_{14} (occD2) + \beta_{15} (occD3) + \beta_{16} (occD4) + \beta_{17} (aexservD1) + \beta_{18} (aexservD2) + \\
 & \beta_{19} (hhsacrtnd1) + \beta_{20} (hhsacrtnd2) + \beta_{21} (techdyfcD1) + \beta_{22} (techdyfcD2) + \\
 & \beta_{23} (mkt inf onD1) + \beta_{24} (mkt inf onD2) + \beta_{25} mkt inf onD3 + \beta_{26} (mktstbltD1) + \\
 & \beta_{27} (mktstbltD2) + \beta_{28} (mktstbltD3) + \varepsilon
 \end{aligned}
 \tag{1b}$$

We estimated equation 1b by means of ordered probit model. We assumed SWB_i^* to be a categorical variable and thus we cannot observe the exact level of satisfaction but only the range in which it lied; and that the answer to the subjective well-being question provides an ordinal ranking and not cardinal; Also ordinal interpersonal comparability assumed, for example a pyrethrum farmer i answering "5" is more satisfied or happier than pyrethrum farmer i , answering "1" but not necessarily five times as happy or satisfied

Regression results

We run the ordered probit regression to ascertain the influence of the marketing factors demographic variables and socio-economic characteristics of farmers. The ordered probit model was opted because the respondents' responses on satisfaction-with-life as a whole question did have more than two possible answers which were all mutually exclusive and exhaustive and there was an ordering (hierarchy) among the responses ranging from negative to positive.

Table 1 shows the results of this regression. The results show that the number of household members, yearly average income of household heads, total size of owned land of the household heads, sex of household heads, occupation (government sector employees and private sector

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employees), agriculture extension services, marketing factors of rural farm transport, technological type of drying facilities, market information and market stability, all indicated positive or negative influence on subjective well-being of pyrethrum farmers in the Makete district.

Table 1. Regression results

Variables	Coef .	Std.Error	Z	P> Z	Marginal effect
techdyfcD1= technological type of drying facilities dummy1	.0755156	.2131069	-0.35	0.723	.0086236
techdyfcD2= technological type of drying facilities dummy2	1.636622	.594336	2.75	0.006	-.0581521
mktinfonD1=market information dummy1	-.0138212	.2545098	-0.05	0.957	.001528
mktinfonD2= market information dummy2	1.239024	.5410138	2.29	0.022	-.0561848
mktinfonD3=market information dummy3	.1028715	.8156329	0.13	0.900	-.0103932
mktstbltD1= market stability dummy1	.9627299	.2820913	2.41	0.001	-.0595873
mktstbltD2= market stability dummy2	.8627035	.577996	1.49	0.136	-.0493033
mktstbltD3=marketstabilityD3	-.0298607	.6093874	-0.05	0.961	.0033464
hhsacrtnD1= household's satisfaction rural farm transport dummy1	-.1147156	.2124866	-0.54	0.0589	.0133472
hhsacrtnD2 = household's satisfaction rural farm transport dummy2	-1.433827	.7294625	-1.97	0.049	0.3725028
lnnhhm = natural log of number of household members	1.41875	.5906301	2.40	0.016	-.155481
lnnhhm_sq = square of natural log of number of household members	-.7150735	.2598015	-2.75	0.006	.078365
lnyaitshs = natural log of yearly average income in Tanzania shillings	7.428189	2.205783	3.37	0.001	-.8140566
lnyaitshs_sq = square of natural log of yearly average income in Tanzania shillings	-.2575436	.0800831	-3.22	0.001	.0282243
Intszlowhh = natural log of total size of land owned by household heads	.3306453	.1346858	2.45	0.014	-.0362355
lnage = natural log of age of household heads	2.226423	4.82813	0.46	0.645	-.2439941
lnage_sq = square of natural log of age of household heads	-.3101198	.6463186	-0.48	0.631	.0339861
sex D = sex of household head dummy	.4696883	.2079494	2.26	0.024	-.0408492
eduD1 = illiterate education of household head (dummy1)	-.2410433	.2319135	-1.04	0.299	.0304091
eduD2 = secondary education of household head (dummy2)	-.1321699	.312276	-0.42	0.672	.0157963
eduD3 = vocational training education of household head (dummy3)	.8374533	1.113052	0.75	0.452	-.0470079
eduD4 = University education of household head (dummy4)	-.3114566	.1.1135	-0.28	0.780	.0434333
occD1 = occupation of household head (Government employee dummy1)	-.9172435	.4361676	-2.10	0.035	.1847286
occD2= occupation of household head (Private sector employee dummy2)	1.7242	.6173477	2.79	0.005	-.0571165
occD3 = occupation of household head (retired dummy3)	1.063709	.5605212	1.90	0.058	-.0533997
occD4 = occupation of household head (business dummy4)	-.1011035	.831602	-0.12	0.903	.0119957
aexservD1= agricultural extension services (ward extension officer dummy1)	.108656	.1745238	0.62	0.534	-.0114971
aexservD2 = agricultural extension services (other dummy2)	-.1.719138	.5102702	-3.37	0.001	.4792234

Source: Computed from field data collected in 2014.
Observations=267, Prob>chi2=0.0000, Pseudo R2=0.1614.

DISCUSSION

This study analyzed subjective well-being using marketing factors and pyrethrum farmers' characteristics. Findings showed that, most study variables had a positive significant influence on subjective well-being.

Technological type of drying facilities

Technological type of drying facilities had a positive significant influence on subjective well-being at a 10% level of significance. Farmers who were uncertain with the drying facilities, as opposed to those who were very dissatisfied with the drying facilities, had a probability of increasing their subjective well-being. This finding implies that pyrethrum farmers' satisfaction with the way they lived after starting selling pyrethrum was significantly dependent on how they were satisfied with the type of drying facilities used. This finding was in support of (Asfaw et al. 2012; Sharma & Singh, 2015); and (Tang et al 2015). These studies showed a significance influence of modern agricultural technologies on the consumption expenditure in rural Ethiopia and Tanzania.

Market information

Market information had a positive significant influence on subjective well-being at a 5% level of significance. Farmers who were uncertain with market information compared to those farmers who were very dissatisfied with market information had a probability of increasing their subjective well-being. This finding implies that farmers' satisfaction with the way they lived after starting selling pyrethrum was significantly dependent on how they were satisfied with the access of market information. This finding was in support of (Alemu et al. 2006) who revealed that better market information is highly associated with higher chances of attaining the improved well-being among small scale farmers in Ethiopia. Additionally, better market information was highly associated with higher profitability and thus reduced poverty of farmers. His study also suggested supplementing market information with agricultural extension services as to assist farmers in rural areas to encompass better understanding of the market information and its usefulness.

Market stability

Market stability had a positive significant influence on subjective well-being at a 1% level of significance. Farmers who were dissatisfied with market stability as contrasting to those farmers who were very dissatisfied with market stability had a probability of increasing their subjective well-being. This finding implies that farmers' satisfaction with the way they lived after starting selling pyrethrum was significantly reliant on how they were satisfied with the stability of the pyrethrum selling markets.

This finding is supported by (PIDTF, 2011) revealed that stable markets guarantee for stability of pyrethrum sales' income which in turn increases the chances of higher levels of subjective well-being among pyrethrum farmers.

Rural farm transport

Rural farm transport (dummy 1) had a negative significant influence on subjective well-being at a 10% level of significance. Farmers who were dissatisfied with rural farm transport as opposed to those farmers who were very dissatisfied with rural farm transport had a probability of decreasing their subjective well-being. And rural farm transport (dummy 2) had a negative significant influence on subjective well-being at a 5% level of significance. Farmers who were dissatisfied with rural farm transport as contrasting to those farmers who

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were very dissatisfied with rural farm transport had a probability of decreasing their subjective well-being. Farmers who were uncertain with rural farm transport in contrast to those farmers who were very dissatisfied with rural farm transport had a probability of decreasing their subjective well-being. Findings imply that farmers' satisfaction with the way they lived after starting selling pyrethrum was significantly not reliant on how they were satisfied with rural farm transport they used. This finding is not supported by Ali et al., (2015) whose results indicated positive influence of transport on subjective well-being of farmers in Nigeria. Findings also supported by (Bow brick, 1996) a good transport influences pyrethrum sales income due to the fact that good rural farm transport preserves the quality of raw pyrethrum flowers. Other studies that supported study at hand, suggest that marketing in agricultural produces at present is very constraint as the state of transport is poor and does not encourage increased agricultural production which leads to low agricultural produce for marketing (Hooder & Ukwu, 2013; Malimbwi et al., 2009; Pradhan, 2006).

Number of household members (Size of household)

Number of household members had a positive significant influence on subjective well-being at a 5% level of significance. The square number of household members had a negative significant influence on the subjective well-being at a 1% level of significance. This implies that the subjective well-being of the household members was significantly non-linear in the effect of size, decreasing after the size of approximately 3 individuals in the household. This

is obtained by solving for household size, where $\frac{d}{d \ln(size)}$ $1.41875 \ln size - 0.7150735 \ln size^2 = 0$. Consequently, this study suggests a '∩-shaped household size-wellbeing relationship' for farmers in the Makete district. This further implies that, at the beginning, households with sizeable large number of household members would beneficially use the large number of household members to offer cheap labour force. This, however, would not be indefinitely. The scenario would change when the size of the household member reaches the saturation point of 3. After this saturation point, the trend changes direction and starts to decline due to, inter alia, the large expenditures on meals, education, medication, and other family obligation costs.

Yearly average income of pyrethrum farmers

Yearly average income of pyrethrum farmers had a positive significant influence on subjective well-being at a 1% level of significance. Square of yearly average income of pyrethrum farmers had a negative significant influence on subjective well-being at a 1% level of significance.

This implies that the subjective well-being of the household members was significantly non-linear in the effect of the yearly average income of the pyrethrum farmers, decreasing after the income has reached Tanzanian Shillings 1.83 million. This is obtained by solving for yearly average income, where $\frac{d}{d \ln(income)}$ $7.428189 \ln income - 0.2575436 \ln income^2 = 0$.

Thus suggesting a '**∩-shaped yearly average income-wellbeing relationship**' for farmers in this district. This further implies that as income increases the subjective well-being increases as well up to the saturation point of Tanzanian shillings 1.83 million after which the subjective well-being starts to decrease. At the individual level, we would expect happiness and income to correlate positively throughout, but surprisingly there would be a

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saturation point after which happiness starts decreasing! This is worldwide termed as “the Happiness-Income paradox” (see Y. Zee Ma and Ye Zhang, 2014; Easterlin, 1974, 1995, 2001, Easterlin, R.A., and Angelescu L. (2009)). This paradox has been widely debated among economists and the controversy has persisted for several decades now. This study has confronted the same paradox.

Total size of land owned by farmers

Total size of land owned by farmers had a positive significant influence on subjective well-being at a 1% level of significance. This implies that larger total size of land owned by some farmers' households had an opportunity to produce more pyrethrum flowers which in turn would make them earn more money thus leading to satisfaction with life.

Sex of pyrethrum farmers

Sex of pyrethrum farmers had a positive significant influence on subjective well-being at a 5% level of significance. This implies that the female pyrethrum farmers are very satisfied with their life comparing to their male counterparts. There is no strong reason to be established as to why this is the case.

Occupation of pyrethrum farmers

The analysis here was done on the household head if he was a government sector employee, private sector employee and a retired person. Results show that being a government sector employee had a negative significant influence on subjective well-being at a 5% level of significance; being a private sector employee had a positive significant influence on subjective well-being at a 5% level of significance and being a retired person had a positive significant influence on subjective well-being at 10% level of significance. The government sector employees who categorized themselves as being just dissatisfied compared to those who were very dissatisfied had the probability of decreasing their subjective well-being. Private sector employees who perceived uncertainty comparing to their counterparts who were very dissatisfied had a probability of increasing their subjective well-being. The retired individuals who perceived satisfaction with life in comparison to those who were very dissatisfied had a probability of increasing their happiness after selling their pyrethrum.

Agricultural extension services

Regarding the agricultural extension services; the other extension officers had a negative significant influence on subjective well-being at a 1% level of significance. Farmers who were very satisfied with other extension officers, as opposed to those who were very dissatisfied with other extension officers had a probability of decreasing their subjective well-being. This finding implies that farmers' satisfaction with the way they lived after starting selling pyrethrum was significantly not reliant on how they were satisfied with agricultural extension services they used. This finding is in support of Tang et al., (2015) who affirmed that availability of agricultural extension services to small farmers are very important for their achievements and thus could affect their well-being positively.

CONCLUSION

This Study shows that marketing factors namely, rural farm transport, technological type of drying facilities, market information and market stability had influence on subjective well-being of pyrethrum household heads. For demographic variables, sex of pyrethrum farmers had significant influence on subjective well-being, while age of pyrethrum farmers had no

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significant influence on subjective well-being and socio-economic variables, such as number of household members yearly average income of pyrethrum household heads, occupation (Government sector employee; private sector employee and retired), agricultural extension services and total size of land owned by farmers had significant influence on subjective well-being. Education levels had no influence on subjective well-being. Majority of pyrethrum household heads showed to be very dissatisfied or dissatisfied with marketing factors and farmers' characteristics at rural primary marketing level in Makete district, Southern highlands, Tanzania.

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Acknowledgement

The corresponding author and co-author, to the highest degree do appreciate to all who participated in one way or another to assist in the development of the research process. In a special way, our grateful appreciation goes to all the pyrethrum farmers in the Makete district who willingly participated in the study by giving the required information via the questionnaires administered to them.

Conflict of Interest

The author declared no conflict of interest.

How to cite this article: Kwikwega Z.A.& Dimoso R.L. (2020). Analysis of subjective well-being by influence of marketing factors and pyrethrum farmers' characteristics in makete; Tanzania. *International Journal of Indian Psychology*, 8(4), 1293-1307. DIP:18.01.141/20200804, DOI:10.25215/0804.141

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APPENDIX 1

Regression results of Subjective well-being of pyrethrum farmers

```
. oprobit welbeing lnage lnage_sq sexD eduD1 eduD2 eduD3 eduD4 occD1 occD2 occD3 occD4 lnnhnm 1
> nnnhm_sq aexservD1 aexservD2 hhsacrtnD1 hhsacrtnD2 techdyfcd1 techdyfcd2 mktinfonD1 mktinfonD
> 2 mktinfonD3 mktstbltd1 mktstbltd2 mktstbltd3 lnyaitshs lnyaitshs_sq lntszlowhh
```

```
Iteration 0: log likelihood = -328.24091
Iteration 1: log likelihood = -276.32727
Iteration 2: log likelihood = -275.27315
Iteration 3: log likelihood = -275.26813
Iteration 4: log likelihood = -275.26812
```

```
Ordered probit regression                               Number of obs   =       267
LR chi2(28)                                           =       105.95
Prob > chi2                                           =       0.0000
Pseudo R2                                             =       0.1614
Log likelihood = -275.26812
```

welbeing	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lnage	2.226423	4.82813	0.46	0.645	-7.236538	11.68938
lnage_sq	-.3101198	.6463186	-0.48	0.631	-1.576881	.9566414
sexD	.4696883	.2079494	2.26	0.024	.0621149	.8772616
eduD1	-.2410423	.2319135	-1.04	0.299	-.6955843	.2134998
eduD2	-.1321699	.3122768	-0.42	0.672	-.7442213	.4798815
eduD3	.8374533	1.113052	0.75	0.452	-1.344089	3.018996
eduD4	-.3114566	1.1135	-0.28	0.780	-2.493877	1.870964
occD1	-.9172435	.4361676	-2.10	0.035	-1.772116	-.0623706
occD2	1.7242	.6173477	2.79	0.005	.5142211	2.93418
occD3	1.063709	.5605212	1.90	0.058	-.0348923	2.16231
occD4	-.1011035	.831602	-0.12	0.903	-1.731014	1.528806
lnnhnm	1.41875	.5906301	2.40	0.016	.2611358	2.576363
lnnhm_sq	-.7150735	.2598015	-2.75	0.006	-1.224275	-.2058718
aexservD1	.108656	.1745238	0.62	0.534	-.2334044	.4507164
aexservD2	-1.719138	.5102702	-3.37	0.001	-2.719249	-.7190266
hhsacrtnD1	-.1147156	.2124866	-0.54	0.589	-.5311817	.3017505
hhsacrtnD2	-1.433827	.7294625	-1.97	0.049	-2.863547	-.0041069
techdyfcd1	-.0755156	.2131069	-0.35	0.723	-.4931974	.3421662
techdyfcd2	1.636622	.594336	2.75	0.006	.4717447	2.801499
mktinfonD1	-.0138212	.2545098	-0.05	0.957	-.5126514	.4850089
mktinfonD2	1.239024	.5410138	2.29	0.022	.1786565	2.299392
mktinfonD3	.1028715	.8156329	0.13	0.900	-1.49574	1.701483
mktstbltd1	.9627299	.2820913	3.41	0.001	.4098411	1.515619
mktstbltd2	.8627035	.577996	1.49	0.136	-.2701479	1.995555
mktstbltd3	-.0298607	.6093874	-0.05	0.961	-1.224238	1.164517
lnyaitshs	7.428189	2.205783	3.37	0.001	3.104933	11.75144
lnyaitshs_sq	-.2575436	.0800831	-3.22	0.001	-.4145036	-.1005836
lntszlowhh	.3306453	.1346858	2.45	0.014	.066666	.5946246
/cut1	56.49074	17.63239			21.9319	91.04958
/cut2	57.11861	17.63634			22.55202	91.68519
/cut3	57.71108	17.64198			23.13344	92.28871
/cut4	60.39901	17.65624			25.79342	95.00461

Variable description and measurement

Variable	Description	Measurement	Indicators of variables
Subjective economic welfare	Perceptions on different levels of income.	Income Evaluation Question (IEQ)	Response rating
Subjective economic well-being	Perceptions on life experience after starting selling pyrethrum.	Satisfaction with-life as whole question (five points satisfaction scale)	Response rating
Socio-economic variables			
Age	Age of household head	Scale in Years	Number of years
Sex	Biological gender difference of household head	Nominal category: sexD (1 if female, 0 otherwise)	Gender category
Education	Literacy level of household head	Ordinal: literacy levels: : eduD1 (1 if no schooling and 0 otherwise); eduD2 (1 if secondary education and 0 otherwise)	Level of Education attained

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Variable	Description	Measurement	Indicators of variables
); eduD3 (1 if Vocational training and 0 otherwise); eduD4 (1 if University and 0 otherwise).	
Occupation	The primary activity of the household head.	Nominal category: occD1 (1if government employee and 0 otherwise); occD2 (1 if private sector employee and 0 otherwise); occD3 (1 if retired and 0 otherwise); occD4 (1 if business and 0 otherwise)	Nature of occupation and status of occupation
Number of household members	How big or small is the household depending on the number of its members	Scale: number of household members	Number of members in the household
Total size of land owned by household heads	How big is the farm being cultivated for pyrethrum production	Scale: square acres	Number of acres or hectares for cultivation
Yearly average incomes of household heads	Yearly total average of all incomes of household members from pyrethrum and different sources	Scale in Tshillings.	Amount of money earned by the household
Agricultural extension services	Access to technical advice and instructions regarding pyrethrum production and marketing from personnel	Nominal category: Village Extension officer Ward extension officer Division extension officer Neighbor /Friends Other (to be specified)	Availability of qualified extension officers, commitment and distance from farm households to agricultural service offices.
Variable	Description	Measurement	indicators of variables
Marketing Factors			
Rural farm transport	Way of transporting pyrethrum harvests from farms to farm households, thereafter to local selling centers.	Nominal category: hhsacrftD1 (1 if very dissatisfied and 0 otherwise); hhsacrftD2 (1 if dissatisfied and 0 otherwise).	Response rating
Technological type of drying facilities	Modern or artificial type of drying facilities used by pyrethrum farm households for drying pyrethrum flowers	Nominal category: techdyfcD1 (1 if very dissatisfied and 0 otherwise); techdyfcD2 (1 if dissatisfied and 0 otherwise).	Response rating
Market information	Availability and accessibility of market information among pyrethrum farm households.	Nominal category: mktinfonD1 (1 if very dissatisfied and 0 otherwise); mktinfonD2 (1 if dissatisfied and 0 otherwise); mktinfonD3 (1 if uncertain and 0 otherwise).	Response rating
Market Stability	How stable is the pyrethrum market.	Nominal category: mktstbltD1 (1 if very dissatisfied and 0 otherwise); mktstbltD2 (1	Response rating

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Variable	Description	Measurement	Indicators of variables
		if dissatisfied and 0 otherwise); mktstbltD3 (1 if uncertain and 0 otherwise).	

APPINDEX 2

FINDING VALUE AT THE TURNING POINT USING COEFFICIENTS OF TWO PARTICULAR REGRESSED VARIABLES IN TABLE 1

Variable A: Natural logarithm of number of household members, (ln (nhhm)) and natural logarithm of number of household members square (ln (nhhm)²):

Coefficient of ln (nhhm) = 1.41875

Coefficient of ln (nhhm) square = 0.7150735

F (nhhm) = 1.41875 (ln (nhhm)) – 0.7150735 (ln (nhhm)²)

Let ln (nhhm) = x

F(x) = 1.41875x-0.7150735x²

The trend direction changes at dF/dx = 0

Thus: dF/dx = d/dx (1.41875x – (0.7150735x²))

Differentiation gives:

1.41875 – 2(0.7150735x) = 0

Open brackets and rearrange the equation, gives:

1.4301470x = 1.41875

Solving for x,

x = 1.41875/1.4301470

x = 0.9920308891

Recall,

ln (nhhm) = x (Apply exponential on both sides) gives, ln (nhhm) = e^x = e^{0.9920308891}

Therefore x = 0.9920308891, because e^{ln (x)} = x and e^{ln (nhhm)} = nhhm

Why? Reason: A function of its inverse is identity function which maps a variable to itself.

This means F (f⁻¹) = Identity

F (f⁻¹(x)) = I (x) = x

Recall, e^{ln (nhhm)} = nhhm, and nhhm = e^x, thus nhhm = e^{0.9920308891}.

Finding value of e^x which is equal to e^{0.9920308891} by using calculator or other devices of the same. When a household happen to have 3 household members, that is where a turning point occurs, and a trend direction starts to drop.

Variable B: Natural logarithm of yearly average income in Tanzania shillings (ln (yaitshs)) and Natural logarithm of yearly average income in Tanzania shillings square (ln (yaitshs)²)

Coefficient of ln (yaitshs) = 7.428189

Coefficient of (ln (yaitshs) square = 0.2575436

F (ln (yaitshs) = 7.428189 (ln (yaitshs)) – 0.2575436 (ln (yaitshs)²)

Let ln (yaitshs) = y

F(y) = 7.428189y – 0.2575436y²

The trend direction changes at dF/dy = 0

Find derivative of F(y) = 0

Thus: dF/dx = 0 = d/dx (7.428189y – 0.2575436y²)

After differentiation, we obtain:

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$$F(y) = dF/dy = 7.428189 - 2(0.2575436y) = 0$$

Open brackets and rearrange the equation to obtain

$$0.5150872y = 7.428189$$

$$y = 7.428189/0.5150872 = 14.421226154$$

$\ln(\text{yaitshs}) = y$ (Applying exponential throughout the equation gives):

$$e^y = e^{14.421226154}$$

Therefore $y = 14.421226154$, because $e^{\ln(y)} = y$ and $e^{\ln(\text{yaitshs})} = \text{yaitshs}$.

A function of its inverse is identity function which maps a variable to itself.

This means $F(f^{-1}) = \text{Identity}$.

$$F(f^{-1}(y)) = I(y) = y.$$

Finding value $e^y = e^{14.421226154}$

What is the Income (yaitshs) at the point where trend direction changes?

Find value of $e^{14.421226154}$ to give the yearly average income in Tanzania shillings.

This value, is Tanzania shillings 1,832,556.63. This means that as income increases, the subjective well-being increases as well-being starts to decrease. (This is a saturation point (turning point where trend direction starts to change downwards)).