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Micro-level determinants of woodland conversion to arable lands and implications for policy in Eastern Nigeria: A factor-factor analysis

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The study empirically examined the micro-level determinants of woodland conversion to arable lands in the Sub-Saharan Region of Africa, taking Eastern Nigeria as an example. This is informed by the increasing effect of land-use change in recent time. The study was based on a sample size of 291 farmers from Enugu State, Nigeria. Three sets of micro-level factors (farmers' agent action/practices; farmers' decision factors/characteristics; and institutional parameters) were examined. Specifically, land access, credit access, market access, technology access, tenure regime, leadership status, and membership of farmer groups, were the institutional parameters examined. Farmers' background, preferences and resources such as land per capita, woodland dependency for livelihood, off-farm employment, fallow period, farming experience, educational background, farm holding/size, economic orientation and age were the farmers' decision parameters examined. Using the Kaiser or Eigen value criterion, the analysis produced seven principal components (PCs) and non-zero loadings on each PC. The result indicated that the highest subsumed indicants with their respective factor loadings are conservation technology (67%), education (84%), woodland/forest dependency for income (37%), membership of rural group (31%), dependency on fuelwood for domestic energy (38%), economic orientation of the people (24%) and credit access (31%) for PC1, PC2, PC3, PC4, PC5, PC6 and PC7 respectively. This implies that, 84% of the illiteracy (education) is associated with the variances of the hypothesised set of common factors for PC2. The findings indicated that policies that could improve economic status of the rural communities will positively affect adoption of improved technology, and access to yield enhancing technologies that will certainly reduce interference on forest or woodland.

Key words: Factor-factor analysis, woodland conversion determinants, forest conversion, land-use change, arable cropping, principal component extraction, farmers' characteristics, institutional parameter.

INTRODUCTION

Background information and problem statement

In many ways, obviously, the world is a radically different place than it was at the dawn of human agriculture. But perhaps the most visible change over the last 10,000 years has been in the planet's green roof (its forest cover). According to FAO (2007), global forest cover amounts to just under four billion hectares, covering about 30 percent of the world's land area. From 1990 to 2005, the world lost 3% of its total forest area, an average decrease of some 0.2% per year, (FAO, 2007). From 2000 to 2005, up to 57 countries reported an increase in forest area, while 83 reported a decrease. Many countries like China have even begun a trend of

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Figure 1. Woodland conversion for farming in the Eastern Nigeria.

"afforestation," which means they plant more trees than they clear. This is important for developing a carbon sink that improves carbon sequestration. A single tree can take between 50 to 100 kilograms of small particles, like carbon dioxide, out of the air in a year and produce three-quarters of a human's oxygen needs. However, the net forest loss remains at 7.3 million hectares per year or 20,000 hectares per day, equivalent to an area twice the size of Paris.

Ten countries account for 80% of the world's primary forests, of which Indonesia, Mexico, Papua New Guinea and Brazil saw the highest losses in primary forest in the five years running from 2000 to 2005. Africa and Latin America and the Caribbean are currently the two regions with the highest losses. Africa, which accounts for about 16 percent of the total global forest area, lost over 9% of its forests between 1990 and 2005. Latin America and the Caribbean, with over 47% of the world's forests saw an increase in the annual net loss between 2000 and 2005, from 0.46 to 0.51%.

Even though the rate is slowing down in developed countries, in Nigeria, forest and woodland have been disappearing at an alarming rate due to high investment in oil exploration, urbanization, increasing level of rural poverty among other factors.

Woodland conversion to arable cropping is a form of land-use change which happens at the micro-level and is the result of the complex interaction between the human and the physical environment. It is a continuous evolving process and the single most important manifestation of human interaction with land cover. It is linked with human impact on the environment and with woodland or forest resource management. It occurs through the pathway of increases in agricultural production, dependence on woodland products by rural people to eke a living by clearing for agricultural production as seen in (Figure 1) and exploitation of woodland frontiers by the government to achieve socio-economic goals. Though the expropriation of woodlands or forest from the traditional system has brought visible signs of environmental degradation such as loss of biodiversity, desertification, gully erosion, global warming, war and conflict, evidence of further degradation persists, mostly in the developing world, even as the world is getting worried on the increasing climate change and its impact.

The trend indicates that 80% of the forest that originally covered the Earth has been cleared, fragmented or otherwise degraded (WRI, 1994). A survey by Shepherd et al (1993) shows that the world forests were estimated to have covered 5.2 billion hectares or about 40% of the total land space. But, FAO (1997) reported a drastic reduction to 3.5 billion hectares from 1993 estimate. The FAO report also shows that between 1980 and 1995, the world's woodland decreased by about 180 million hectares, an area which according to the report is about the size of Indonesia or Mexico. This represents annual loss of 12 million hectares as at 1996. In updating the data, FAO (2003) indicated that the net global change in woodland area between 1990 and 2000 was estimated at -9.4 million hectares per year: the sum of -14.6 ha of deforestation and 5.2 million hectares of gain in forest cover. This represents a global change of -0.22% per year. The report also stated that total standing wood volume (m^3) and above ground woody biomass (tonnes) in forest was estimated for 166 countries, representing 99 percent of the world's forest area. The world total standing volume in the year 2000 was 386 billion cubic meters of wood. The global total above ground woody biomass was 422 billion tones. This scenario indicates continuous loss of woodland from its original status.

The world is still concerned about how to stop and begin to reverse woodland conversion. But this will be quicker when it knows the factors that encourage conversion and operational dimension of the identified factors. Adger and Brown (1994) presented a set of factors influencing woodland conversion as population increase, poverty, debt and macro-economic adjustments, policy and market failures, agricultural practices, and natural/ environmental occurrences. While Adegboye (1984) attributed woodland conversion to market forces, that is, the interplay of demand and supply, Adger and Brown (1994) believed that the changes in land-use result from socio-cultural and economic forces within the context of which physical environment acquires a function as a medium for production. However, arguments still exist between foresters, ecologists and land authors on the influence of these factors on woodland-use change. For example, Colchester and Lohmann (1993) argued that the problem starts with perverse and inequitable agricultural policies in which erosion of land rights in agricultural systems results in marginalisation and impoverishment of small farmers that consequently lead to colonization of wooded areas.

But, Richards (1990) and Boserup (1985) argued that population expansion of the subsistence farmers is the underlying cause of woodland conversion since according to them, it is the primary determinant of land availability to users' demand. Mather (1990) in his 'Forest Transition' postulated that the level of economic development and population increase determine the demand for forest products, forest cover and other land resources. Interestingly, FAO (2000) stated that West African countries have limited woodland resources (approximately 11% of the total land area) because of the sahelian climate (countries of the Sahelo - Sudanese Zone), large population (Nigeria, Benin, Togo), wood products export (Cote-d'Ivoire, Nigeria), and mineral exploration (Nigeria, Cote d'Ivoire, Burkina Faso, Guinea, and Ghana). The exploration and exploitation of minerals in those countries have further put land under intensive pressure. From another point of view, Rivkin (1986) believed that land alteration is mostly exacerbated by the incidence of natural disaster and the ecology which determines the carrying capacity of land to meet peoples' needs. Disease outbreak (such as experienced by cassava farmers for cassava mealybug in 1980's in Nigeria) could force land-users to change choice of land and open forestland or woodland. Earthquake, gully erosion and fire outbreak are other natural phenomena, which could compel land users to open new land or cause access to the affected land cover.

Following from the above, it could be seen that the debates among foresters, ecologists, agriculturists and land authors on the determinants of woodland conversion though still inconclusive, revealed that a range of factors are involved. No one factor has been identified to cause the conversion alone, and no much effort to seek the relationship or interaction of those factors with one another in the conversion process has been made in the recent time. Therefore, a less frequent argument in the determinants of woodland conversion to arable cropping is the influence of micro-level underlying factors and the realization that one cause of conversion could interact with another one to exert a change. Suffice to say that most authors in this subject have failed to take cognizance of the fact that farmers background and orientation, including the institutional framework governing their living in the rural areas, interwove largely to affect their decision to clear or not to clear their woodland for other uses. In reality, woodland conversion is rarely a simple process. More often than not, it results from a complex chain of events, involving a number of different agents and causes in each locality and point in time. But despite this understanding, no attempt has been made by research to investigate the interdependency of these agents, underlying factors and or proximate variables in forest change, woodland conversion or related subject.

Recent attempts by scholars in this field have provided empirical analyses of the form and pattern of woodland conversion by a wide range of factors and concluded that conversion is influenced by a set of three factors. The first set of factors according to the authors Stietenroth et al. (2005) was the farmers agents/actions regarded also as their farmers' inherent behavior and practices (arable cropping, cash cropping/plantation agriculture, timber/ non-timber exploitation, ranch/livestock development, housing development and fuel wood exploitation). The second set of factors were farmers decision parameters and characteristics also regarded by the authors as their background, preferences and resources (land per capita, woodland dependency for livelihood, off-farm employment, period of fallow, farming experience, educational background, farm holding/size, economic orientation and age). The third set of factors was institutional parameters (Specifically, land access, credit access, market access, technology access, tenure regime, leadership status, and membership of farmer groups). However, even though the authors were able to infer that land conversion is caused by a wide range of factors, no attempt was made to unravel the interaction process in relation to the level of contribution of one factor to the other as well as the interdependency of the factors in the woodland conversion process to arable cropping. This research was basically designed to fill this gap and deepen the understanding and knowledge about the conversion process in order to provide policy with a sustainable intervention framework that could impact positively on all the agents or factors of woodland conversion. It focuses on empirical analysis of the interaction of the statistically established underlying micro-level variables with one another in woodland conversion to arable cropping. Therefore, this study deepened on the findings of Stietenroth et al. (2005) and analyzed the interaction and/or interdependency of underlying micro-level factors of woodland conversion to arable cropping.

The value of this rural based work is obvious: the description and empirical analysis of the factors and their interaction process in the rural setting will enable research and key actors in the public sector to come up with a comprehensive strategic framework that will arrest the increasing land-use change in forest and/or woodland conversion to arable cropping in the rural poor settlement areas of Enugu State, Nigeria.

Objectives of the study

The general objective of the study was to investigate the interaction and inter-dependency of the micro-level determinants of woodland conversion to arable cropping in Enugu State, Nigeria. The specific objectives are to:

1. Explore the interactions of farmers' characteristics and institutional factors and their roles in influencing woodland conversion in the rural areas of Enugu State, Nigeria; and
2. Make recommendations for policy, based on the findings.

Research hypotheses

Based on the specific objectives this research tested the hypothesis which states that:

Farmers' background, preferences, characteristics, resources and institutional parameters do not act interwovenly to influence their choice of woodland conversion to arable cropping.

Justification

Changes in land use types are evident resulting from pragmatic change in communal right holding to family holding and then to individual holding. The transfer is accompanied with flexibility in the choice of land use by the beneficiary. Eboh and Lemchi (1994) noted the interlink between economic status of household when they reported on the gradual emergence of land markets where lands including forestland, woodland or scrubland are rented, loaned, pledged or sold/bought outright by other people for other uses. According to them, the conventional poverty-environment argument is that poorer families are more likely to clear the forest or woodland, either to grow crops, or to cut wood. The counter argument says such families are not likely to do so because they lack the necessary capital to put additional land into production (Rudel, 1993).

The same argument goes for agro-chemicals such as fertilizer. The author reported that poorer farmers with no access to fertilizer and other yield enhancing technologies would clear more fertile land for a desirable output level. These arguments seem to conjure a theoretical linkage between land-use conversion with technology, income/economic level, which in some findings relate with educational level of the people.

In reality, as earlier stated, woodland conversion results from a complex chain of events, involving a number of different agents and causes in each locality and point in time. Therefore, this empirical study was designed to analyze and describe the manner in which these variables mutually reinforce each other in woodland conversion.

Though previous emphasis was laid on agricultural production, mineral extraction, fuel-wood, logging and civil works as the direct causes of woodland conversion, much broader and deeper strains in the interaction among the underlying environmental, social, economic and political factors of which the conversion is based are usually ignored. Therefore, successful remedies for rural woodland conversion must be firmly rooted in these broader contexts of interdependency, otherwise interventions may fail.

If planning, or other types of intervention are to create lasting successes they must recognize at least two basic dimensions of woodland conversion: the need for local assessments on agents and factors of woodland conversion and the manner in which those factors interact with one another to cause that conversion. This is because the direction of conversion by one factor is normally reinforced by the forces of another factor. Problems and opportunities to solve them are therefore specific to their manner of interaction. This will enable researchers and policy makers provoke an efficient and effective but all inclusive strategy that will reverse the increasing trend in woodland conversion. Furthermore, the study presented a model for future studies in forestland-use change and woodland conversion determinants and a baseline document that can be improved from time to time in woodland and environmental related studies.

METHODOLOGY

Study area

The study was conducted in the rural areas of Enugu State, Nigeria. The state is located between latitudes 5° 56N and 7° 06N and longitudes 6°31E and 7°55E. The State had a land area of 8000 km^2 or 800,240 ha and a population of 3.3 million persons made up of 1.62 million males and 1.63 million females (NPC, 2006). This corresponds to a population density of 407.2 persons per km^2 in 2006. The population density of 407.2 persons per km^2 overshot the projected densities of 350 persons per km^2 in 2001, and 360 persons/km2 in the year 2005 (NBS, 2008). The trend indicates a continuous decrease in land area per capita and suggests possible incidence of land hunger in future.

The State was purposively chosen because of the presence of large expanse of woodland, existing threat for their conversion to arable cropping and the researchers' familiarity with the rural areas, which assisted in data generation. A multi-stage random sampling was employed to ensure good spread of the respondents in data collection. In selecting sample size, 12 LGAs were purposively identified and selected for having large expanse of woodland. From each of the 12 LGAs, three communities were randomly selected, giving a total of 36 communities where the study was carried out. From each of the communities, nine farmers were randomly selected, giving a total of 324 farmers. Primary data for the study were collected from these selected farmers using structured interview schedule. Data analysis was based on information from 291 farmers. Information from the remaining 33 farmers was not usable.

Data analysis

Data analysis was based on the Principle Component (PC) extraction model, frequently employed in multiple-factor analysis to predict inter-dependency and interaction outcomes among variables, as well as correlation matrix.

Analytical framework

Factor analysis is a statistical technique whose common objective is to represent a set of variables in terms of a smaller number of hypothetical variables. That is, it assumes the existence of a system of underlying factors and a system of observed variables, which is linearly dependent on the underlying factors. It assumes that there is a certain correspondence between these two systems and exploits this correspondence to arrive at conclusions about the level of influence of the respective underlying variables to the observed variables.

The model has the advantage of determining interaction outcome through the use of pattern matrix and structural matrix, to arrive at the characteristics of variables that are most important in classifying, qualifying or capturing dimensions of change like woodland conversion. When the liner weights associated with common factors according to Jeon and Charles (1978) are arranged in a rectangular form, they are jointly referred to as factor path matrix or factor structure matrix or matrix of factor loadings, e.g.:

X1 = b11F1 + b12F2 + d1U1

X2 = b21F1 + b22F2 + d2U2

X3 = b31F1 + b32F2 + d3U3

X4 = b41F1 + b42F2 + d4U4

Xn = bnF1 + bnF2 + dnUn

Path matrix differs from structure in that path matrix consist of standardized linear weights (path coefficients) only, while structure matrix contains respective correlation coefficients between the factors and observed variables. If factors are uncorrelated, that is, one common factor model, a path Matrix is equivalent to a structure matrix: The general form of determining the level or proportion of variance of respective observed variables Xs as determined by the common factor (underplaying factor) is expressed thus:

Var X1 = b21 + d21 or Var X2 = b22 + d22

The weight (b2i and d2i) represents the square of the correlations or square of factor loadings and explains the proportion of the Xs that is determined by the common factor and unique factor receptively. This proportion (that is, the square of the factor loading) is called communality (h2) in factor analysis.

The uniqueness component is 1 - h2, while the covariance of the underlying factors and the observed variable (cov F, X) is their correlation or their standard regression coefficient. The covariance of X1 and X2 is b1b2 when one common factor or orthogonal multiple common factors are involved. Factorial determination of variance refers to the degree to which the observed variables are determined by the common factor: ∑h21/m where m stands for number of variables. This index is the average of proportion of variance of observed variables explained by the single common factor. Significant loadings are those ≥ + 0.30 (absolute value) for sample size of ≥ 50. Also the result of the structural/path matrix expressed in percentage gives the overall factorial determination (D2), which represents a percentage of the variance among the observed variable that is determined by the common factors (Jeon and Charles, 1978). In this study, factor analysis was applied to the sets of specific factors of woodland conversion to arable cropping (comprising: land access, credit access, market access, technology access, tenure regime, leadership status, membership of farmer groups, farmers' background, preferences and resources such as land per capita, woodland dependency for livelihood, off-farm employment, period of fallow, farming experience, educational background, farm holding/size, economic orientation and age). This means a multiple-variable, multiple-factor model of factor analysis using principal component (PC) extraction method to predict interaction outcome. Explicitly, the empirical model is stated as:

$$\mathbf{Y} = \mathbf{W_L}^T\mathbf{X} = \mathbf{\Sigma_L}\mathbf{V_L}^T$$

Where Y = Matrix consisting of N column vectors, where each vector is the projection of the corresponding data vector from matrix ×, W = Matrix of basis vectors (one vector per column), where each basis vector is one of the Eigenvectors of the principal component, PC. X = Data matrix, consisting of the set of all data vectors, one vector per column of the component. V = Matrix consisting of the set of all Eigenvectors of the component, one eigenvector per column of the component.

DISCUSSION AND INTERPRETATION OF RESULTS

Interaction process: Farmers characteristics and decision parameters

Field data were subjected to a correlation (pattern) matrix analysis (Appendix 1) to be able to perform the first level of interaction and understand the inter-dependency of one factor and the other. The analysis as seen in Appendix 1 shows that the correlation (pattern) matrix (P<0.05) of the farmers characteristics and their decision parameters produced negative association (-0.046) between land per capita and technological access, land per capita and agricultural land use intensity or fallow period (-0.085), land per capita and forest dependency for income (-0.173), land per capita and fuel wood dependence (-0.010), land per capita and land tenure arrangement (-0.087), land per capita and off-farm employment (0.037). These are in line with a prior expectation but imply that land hunger has inverse relationship with technology access, fallow period, woodland dependency, and off farm employment. For instance, it indicates that low land per capita ratio influences the use of modern technologies to increase agricultural productivity.

This is a rational behaviour of farmers who are landlocked. It suggests that improved access or availability of high productivity technologies is a feasible model that could reduce land pressure in the rural settings. This linear association could form a policy framework in either woodland or forest rehabilitation or conservation effort or a limiting criterion for woodland conversion to arable cropping. It also means that policies aimed at providing modern technologies or promoting agro-forestry/home forestry for fuel wood will have positive effect in reducing pressure on wooded vegetation land. Similarly, negative association between land per capita and other variables (fallow period, off farm employment, woodland/forest dependency for livelihoods, etc.) indicates similar scenarios as in technological access.

For instance, the inverse linear relationship (-0.085) between land per capita and fallow period intensity implies that low land per capita results in high pressure (conversion) on available land. Also inverse inter-correlation (-0.037) between land per capita and off-farm employment suggests that farmers seek for and engage in more off-farm employment when land becomes limiting to provide enough food to their households. Expectedly, it also shows that individual ownership of land decreases available land probably due to excessive fragmentation and this in turns increases conversion of available woodland to arable cropping. This finding is consistent with the positive correlation recorded between technology access and tenural arrangement (0.104), and negative/ inverse association (-0.181) between technological access and farm holding/size. The implication for policy is that individual ownership enhances technological access

Table 1. Determinants (observed variable) of woodland conversion to arable cropping.

PC1 = Principal Component	Atc = access to conservation programme
Lpc = Land per capita	Ag = Age
Lds = Leadership status	Ed = Educational background
Mka = Market access	Lta = Land Tenure Arrangement
Mrg = Membership of groups	Ec = Economic orientation
Tech = Technology access	Fwd = Fuelwood/woodland dependency
Fta = Forest Tenure	Ofe = Off-farm employment
Fp = Fallow period	Fh = Farm holding/size
Cra = Credit access	Fex = Farming experience

and use. It has also been established by Colchester and Lohmann (1993) that farmers have the propensity to maintain their land by applying all the conservation and improvement technologies than when the land is under communal ownership.

There is a positive association (0.102) between land per capita and economic orientation of the farmers and this is consistent with a prior expectation. The inter-correlation suggests that better economic status (in terms of amount of un-marketed income spent in household feeding) is achieved for farmers with high land per capita ratio. This could be due to poor access to modern technologies, which forced most respondents to agricultural extensification. On the other hand, there is a negative association (-0.30) between forest/woodland tenure and farm holding, which is in line with expectation. This implies that communal forest/woodland ownership limits farm size expansion due to right restriction, which in turn provokes the use of improved technologies. Therefore, policies that make improved technologies available to the farmers will also enhance the conservation of communal forest.

Inter-correlation shows positive association (0.254) between credit access and leadership status, a situation, which suggests that social status is a credibility asset that enhances access to productive credit. Positive association also occurred between credit access and market access (0.343); credit access and membership of group (0.110); credit access and technological access (0.192); credit access and farm income (0.057), credit access and land use intensity. This suggests that the institutional parameters influenced farmers to obtain credit and vice versa. It means that policies that encourage credit availability will form an incentive to membership of groups in technology and market access. Such policy can be in the areas of interest rate reduction, strengthening of rural groups with no government interference, provision of improved technologies at affordable rate and market linkage in the context of value chain approach.

The positive association between credit and land use intensity and its inverse relationship with dependency on woodland/forest for livelihood, indicate that with credit less conversion of woodland to arable cropping is obtainable. This agrees with the findings in the regression analysis where credit did not significantly influence the farmers to clear woodland to arable cropping. According to the respondents, the farm credit obtained from informal financial sector was used to procure improved production packages.

This analysis also indicates that the strongest association occurred with land use intensity and access to conservation program (59%), farm credit and farm size (46%), fuelwood dependency and fallow period (38%), leadership status and market access (38%) leadership status and conservation technology (36%). The least associations occurred with age and land tenure (0.001), membership of rural group and off farm employment (0.07). There was no interaction/association between educational background and land per capita in the correlation matrix. Other significant associations are reflected in Appendix 1.

Principal components (PC) extraction and sufficiency

Principal Components (PC) extraction on the Determinants (Table 1) of Woodland Conversion was used to analyse the proportion of variations in the observed variables that is associated with the common factors.

This research relied on the theoretical framework of Factor Analysis developed by Jeon and Charles (1978) using Kaiser or Eigen value criterion. It produced seven principal components (PCs) also called common factors or underlying hypothetical factors as seen from Tables 2 and 3 to analyze the proportion of the variations in the observed variables that are accounted for by the hypothetical, PC. The research employed both logical (mathematical) and statistical attributes of principal components technique to derive the required interaction solutions and explored common policies that can affect a uniform set of variables.

The matrix of factor leadings from the seven principal components with their appropriate statistics is presented in Table 3. Tables 2 and 3 show that seven significant principal components were extracted from the matrix of

Table 2. Component extraction and total variance expected.

	Initial Eigen values			Extraction sums of squared loadings			Rotation sum of squared loadings		
Component	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.485	18.344	18.344	3.485	18.344	18.344	2.395	12.604	12.604
2	2.254	11.864	30.208	2.254	11.864	30.208	2.126	11.189	23.794
3	1.290	10.103	40.318	1.920	10.103	40.318	1.899	9.994	33.788
4	1.598	8.412	48.723	1.598	8.412	48.723	1.724	9.071	42.859
5	1.257	6.618	55.341	1.254	6.618	55.341	1.708	8.990	51.850
6	1.246	6.559	61.901	1.246	6.559	61.901	1.546	8.137	59.987
7	1.054	5.548	67.449	1.054	5.548	67.449	1.418	7.462	67.449
8	0.996	5.242	72.690						
9	0.909	4.783	77.473						
10	0.757	3.984	81.457						
11	0.646	3.398	84.856						
12	0.604	3.179	88.035						
13	0.576	3.034	91.068						
14	0.492	2.590	93.658						
15	0.426	2.243	95.901						
16	0.331	1.744	99.644						
17	0.242	1.272	100.000						

Source: Analysis of Field Data, 2004.

17 observed variables of farmers' characteristics/decision parameter and institutional factors. The new average Eigen value criterion as seen in Table 3 was used. The rule is to include all the factors or components whose Eigen value is greater or equal to 1. Although the 56% adequacy in the principal component (PC) extraction indicates the probability of more PCs extraction (unsaturated for the matrix) as further substantiated by the high significance level of Chi-Squared (x2) statistic, but the extraction is in line with the recommendation of Thurstone and Mueller (1979), which states that for effective factor analysis, one factor is expected from three variable matrix. Analysis extracted 7 out of 17 observed-variable matrixes, a situation that satisfies Thurstone and Mueller requirements. Also, the 7 PCs extracted, satisfies the definition of factor analysis as a statistical technique whose common objective is to represent a set of variables in terms of smaller number of hypothetical variables. Further extraction could be achieved by varimax matrix rotations criterion or with the application of a more complex statistical packages than SPSS or by expanding the data matrix to accommodate market issues and agro-ecological features which is out of the scope of this study. The trend of the principal components or common factors obtained in the analysis is in-line with the restrictions or rules typically imposed on factor analysis. The rule is that the first factor accounts for as much variation as possible (18%), the second factor accounts for as much of the residual variation (11.86%) left unexplained by the first factor. The third factor accounts for as much of the residual variation (10%) left unexplained by the first two factors. Also, the fourth factor accounts for the residual variation (8.4%) unexplained by the last three factors while the fifth factor is responsible for the residual variation (6.62%) left unexplained by the pervious factors. The sixth factor similarly explains the remaining variation (6.56%) of the unaccounted residual variation and the seventh factor accounted for the residual variation (5.55%) left unexplained by the last six factors, resulting in a cumulative variation of more than 67%

Principal component and interaction effect

The first principal component or common factor was extracted by analysis and has been modeled as follows:

PC1 = -0.046Lpc – 0.29Lds - 0.51Mka + 0.050Mrg - 0.064Tech - 0.43Ft - 0.30Cra -0.64Fp + 0.82Atc - 0.127Ag – 0.35Ed - 0.33Lta + 0.44Ec – 0.16Fdi + 0.074Ofe + 0.70Fh + 0.62Fex

Eigen value = 3.49
% of variation explained = 18.34
Cumulative % of the variation explained = 18.34

The Eigen value, 3.49, determines the inclusion of the

Table 3. Factor structure matrix and principal components of woodland conversion to agricultural use.

	Factor component matrix						
	1	2	3	4	5	6	7
Lpc	-0.046	0.122	0.613	0.080	0.188	-0.246	0.087
Lds	-0.292	-7.306E-02	-5.377E-02	-0.622	-2.415E-03	-2.263E-02	0.398
Mka	-0.506	6.705E-02	0.154	-0.529	-0.210	-0.112	0.174
Mrg	-0.500	0.500	0.335	0.563	6.541E-02	-5.637E-02	0.297
Tech	6.437E-02	5.539E-02	0.444	-9.244E-02	-0.152	0.381	0.138
Ftr	-0.426	-0.102	0.455	0.437	-0.263	-0.202	0.343
Cra	-0.299	0.177	3.921E-02	-0.150	0.274	-2.606E-02	-0.561
Fp	0.644	-0.311	0.218	0.387	-3.285E-02	0.457	0.226
Atc	0.824	2.232E-02	0.129	0.131	-0.137	1.483E-02	8.638E-02
Ag	-0.127	-0.188	0.172	0.334	6.653E-02	0.278	7.350E-03
Ed	0.354	0.920	0.475	0.175	0.469	0.485	0.128
Lta	-0.333	-0.253	0.286	0.148	9.75E-02	9.390E-02	0.308
Ec	0.439	0.202	-0.288	0.219	-0.226	0.493	0.245
Fdi	-0.159	-0.307	-0.610	0.185	-0.162	-0.128	7.093E-02
Ofe	7.426E-02	0.918	-0.191	7.746E-02	0.227	0.187	8.955E-02
Fh	0.701	-8.017E-02	0.161	-0.140	9.788E-02	0.150	0.113
Fex	0.617	9.621E-02	0.167	-0.180	-0.356	0.269	0.164
Eigen value	3.49	2.25	1.95	1.60	1.26	1.25	1.05
% of variation	18.34	11.56	10.10	8.41	6.62	6.5	5.55
Cumulative (%) of variance	18.34	30.21	40.31	48.72	55.34	61.90	67.55
x2				769			
Df				171			
P < .000							
Kaiser-Meyer Measure of sampling adequacy 56%							

Source: Field data analysis, 2004.

component in the common factors extracted for analysis. The rule is to include all the common factors or components, which Eigen value is > 1. The first principal component PC1 explains 18% of the total variation in the woodland data on farmers' characteristics and decision parameters. The covariance or correlation between land per capita and PC1 is 0.29. This is the factor loading or the path coefficient, which represents the measure of the linear association between the indicant and PC1. The square of the factor loading or correlation coefficient (b2), referred to as its communality (hi2) describes the proportion of variance in the observed variable which is determined by the first common factor or PC1. The square of correlation is traditionally known as coefficient of determination and is obtained when the causal system is involved. Specifically, the commonality for Lpc is (0.29)2 or 0.084. This implies that about 8.4% of the variance in land per capita is associated with the variance of PC1. Similarly, 25% each is associated with leadership status and market access indicants. The corresponding percentage variation associated with the PC1 for other indicants are the square of their respective factor loadings. Access to conversation programme has the highest loading (0.824) and as such the strongest correlation with PC1. This implies that about 68% of the variance is subsumed in the PC1. Farm holding/size, credit access, economic orientation also relate positively with the common factor to the tune of 49, 41, 38 and 19% respectively. Also significantly but negatively loaded in the PC1 are leadership status (-0.51), market access (-0.50) technology access (-0.43) woodland dependency for livelihood (-0.42) and land tenure (-0.33). Their levels of association with PC1 are 26, 25, 18 and 11% respectively. The least loaded is educational background and by approximation (0.002%) has no association with the PC1. The pattern of loading involving both negative and positive signs indicates that more than one hypothetical factor are impacting on the indicants. However, the character indicant that most approximates the common factor is access to conservation programme whose 82% of the variation is associated with the common factor. The pattern of loading both in magnitude and signs could isolate institutional and economic factors as those exerting much influence on the indicants to cause farmers decision to clear or not to clear woodland for arable cropping.

The findings also indicate that indicants with uniform signs of factor loadings could be influenced by a common policy. As earlier indicated, policy that favours the highest subsumed indicant, which are conservation and technology will also favour credit access, group membership, and off-farm employment. From this analysis, policy measure aimed at enforcing conservation of woodland will certainly decrease fuel wood dependency for income and domestic energy. By implication such policy will discourage undue land fragmentation, which results in less land per capita. Similarly, policy that promotes off-farm employment will improve the economic orientation of the people, support conservation initiative but facilitate credit access. This is understandable since this study indicates that improvement in economic orientation of the rural people will translate to additional income which could form an effective incentive support strategy to discourage rural people from interfering with woodland. The policy can target enterprise development, linkage with micro-finance for easy access to finance and partnership with private sector to cause a value chain system which has the potential to create services and expand off-farm income opportunities for rural dwellers.

The second principal component was extracted and is represented as follows:

PC2 = +0.122Lpc - 0.073Lds + 0.067Mka - 0.50Mrg + 0.055Tech - 0.12Ft – 0.17Cra -0.31Fp + 0.022Atc - 0.19Ag - 0.92Ed -0.25Ltg + 0.20Ec - 0.31Fdi + 0.918Ofe - 0.080Fh + 0.096Fex

Eigen value = 2.25;
Percent of variation explained = 11.86
Cumulative % of variation explained = 30.21

Analysis also indicates that the second principal component, PC2 also called second common factor accounts for about 12% of the variance in the observed variables or farmers characteristics and the decision indicants of woodland conversion to arable cropping. Some indicants are significantly and positively loaded at $P < 0.000$. They include: education (0.920), off-farm employment (0.918), market access (0.335), membership of rural groups (0.50), and dependency on woodland/forest (0.307). Farm holding, land ownership by inheritance, and dependency on woodland for livelihood are indicants with negative but significant loading. The most subsumed factor loading in PC2 is education with 85%. This is followed by off-farm employment with the same positive sign and level of loading. The implication of this finding is that policy which support education for the small farmers will certainly promote off-farm employment, enhance access to improved technologies, promote membership of groups but discourage increase in farm holdings. It is obvious that when one acquires higher level of education he will be exposed to other employment opportunities and this usually affects the farm holding in the rural setting as migration out of the rural areas is possible for better quality life. This finding implies that effort to increase the literacy level of the people will form a shield for woodland. Education also promotes the search for, and application of productivity increasing technologies which lead to increased income/ output through intensification rather than extensification of holdings. Many studies have shown that area cultivation declines with increasing use of yield improvement options. For instance, between 1980 and 2007, total cassava production in Brazil increased from 23.5 million metric tons to 27.3 while total area cultivated/harvested declined from 2.02 million hectares to 1.94 (FAOSTAT, 2009) resulting from increased application of yield improvement technologies.

A third Principal component was also extracted. This is represented by the equation:

PC3 = -0.613Lpc + 0.054Lds + 0.154Mka + 0.335Mrg + 0.44Tech + 0.46Ft +
0.039Cra + 0.22Fp + 0.13Atc + 0.17Ag + 0.46Ed -0.29Ltg + 0.29Ec - 0.61Fdi - 0.19Ofe + 0.16Fh + 0.17Fex

Eigen value = 1.92
Percent of variation explained = 10.10
Cumulative % of variation explained = 40.31

This analysis also indicates that the third principal component accounts for about 10% of the total variance in the data matrix. The fact that Eigen value is more than 1 indicates that the component explains more of the total variance in the whole set of character indicants than did any other single indicant. Except leadership status, age, land tenure arrangement and woodland/forest dependency for livelihood, which have negative loadings, all the significant loadings are positively loaded in the PC3. These include forest dependency (0.610), educational background (0.475), technological access (0.444), and membership of rural groups (0.335). Land per capita (0.05), economic orientation (0.288), fuel wood dependency (0.126), off farm employment (0.191), and farm income (0.194) were negatively and non-significantly loaded.

The scenario indicates that about 37% of the variation in forest dependency for livelihood is explained by the PC3. The least loading, credit access (0.039), has about 0.15% variance subsumed by the third common factor. The implication of finding in the PC3 is that policy aimed at arresting peoples' dependency on woodland/forest for livelihood will be hinged on those that will promote educational status of the people, access to technologies, and emphasis in existence of rural groups.

The fourth principal component was also extracted. It is represented as:

$$PC4 = -0.080Lpc - 0.622Lds - 0.529Mka + 0.563Mrg - 0.092Tech + 0.44Ft - 0.15Cra + 0.39Fp + 0.13Atc + 0.334Ag + 0.18Ed - 0.15Ltg - 0.22Ec + 0.19Fdi + 0.077Ofe - 0.14Fh - 0.18Fex$$

Eigen value = 1.6
% variation explained = 8.41
Cumulative % variation explained = 48.72

This component explains about 8 % of the total variance in the set of original indicants or observed variables. High significant factor loadings for land per capita (0.62), leadership status (0.53), Age (0.56), forest tenure (0.44) and fallow period (0.39) were obtained. The percentages of variation in the PC4 are 38, 28, 31 19 and 15%. The least loadings are recorded for market access (0.06), membership of rural groups (0.08), and technological access (0.09) and their respective association with the component being 0.4, 0.5, 0.6, and 0.8% respectively. But, except land per capita and leadership status, which have negative loadings, other indicants are significantly positive. The implication is that without good orientation program for village heads on their custodian role in forest/woodland conservation, their social standing will continue to facilitate the conversion of woodlands. Though the component achieves a comparatively greater explanation of the variance of land per capita (38%) the individual pattern is inversely related to the pattern of the component. This gives age with 31% variation an edge over other indicants as the best approximator in the principal component.

The fifth principal component was also extracted and represented as follows:

$$PC5 = +0.188Lpc - 0.024Lds - 0.210Mka + 0.065Mrg - 0.15Tech - 0.26Ft + 0.27Cra - 0.033Fp - 0.14Atc + 0.067Ag + 0.47Ed + 0.098Ltg - 0.23Ec - 0.16Fdi + 0.23Ofe + 0.098Fh - 0.36Fex$$

Eigen value = 1.26
% Variation explained = 6.62
Cumulative % Variation explained = 55.34

Analysis for PC5 indicates that about 6.6% variation in the original indicants is explained by this component. Highest and significantly positive loading occurs in woodland dependency for livelihood (0.613) followed by educational background (0.469). Farming experience is also significantly loaded but has inverse relationship (-0.356) with the component.

Thus about 38, 22 and 13% variations respectively are subsumed in the component for the three observed variables with woodland dependency as the most subsumed variable. Resource use preference or socio economic features of the respondents are suggested as set of the hypothetical factors constituting the 5th principal component.

Extraction of the sixth principal component yielded the following result:

$$PC6 = -0.240Lpc - 0.0226Lds - 0.112Mka - 0.056Mrg + 0.38Tech - 0.20Ft - 0.026Cra + 0.46Fb + 0.015Atc + 0.28Ag - 0.49Ed + 0.094Ltg - 0.49Ec - 0.13Fdi + 0.19Ofe + 0.15Fh + 0.27Fex$$

Eigen value = 1.25
% Variation explained = 6.56
Cumulative % variation explained = 61.90

The result indicates that 6.56% of the total variation in the observed variables is explained by the 5th common factor. Significant loading, in the highest order, is educational background (0.49), economic orientation (0.48), land use intensity (0.45) and technological access (0.38). Statistics shows that 24, 23, 20 and 14% of the variance respectively are explained for by the sixth factor:

The seventh principal component was extracted (Table 4). It is given as follows:

$$PC7 = 0.087Lpc + 0.398Lds + 0.174Mka + 0.297Mrg + 0.138Tech - 0.34Ft - 0.561Cra + 0.23Fb + 0.086Atc + 0.0074Ag - 0.13Ed + 0.308Lta + 0.25Ec + 0.071Fdi + 0.090Ofe + 0.11Fh + 0.16Fex$$

Eigen value = 1.05
% Variation explained = 5.55%
Cumulative % of variation explained = 67.45

The seventh component is the final in the extraction process. It accounts for 5.55% of the total variation in the stream of observed variables. All the indicants present uniform positive coefficient or factor loadings indicating one set of hypothetical factor. Only credit access (0.561), land tenure (0.308), land per capita, (0.398), woodland/forest tenure (0.343) and land tenure (0.308) are significantly loaded. This explains 31%, 9%, 16%, 12%, and 10% of the total variance respectively in the variables. Credit access appears as the hypothetical underlying factor in the seventh principal component being the highest subsumed indicant in PC7. From the analysis as seen in Tables 2 and 3, the overall factorial determination of the variables $\sum b2i/m$, which is also called the latent root of the principal component or total communality is 67.45%. This index is the total variation in the entire observed variables accounted for by the seven principal components or common factors. The remaining (100 - $\sum b2i/m$) or 32.55% is attributed to the unique factors not captured in the research. Also, the total variation in an observed variable or individual indicant derived from the sum of the absolute values of factor loadings, 3$\sum$b2i3 in each row or along the horizontal axis indicates the respective communalities, $\sum h2i$. This index is also the proportion of the variation in an individual or particular observed variable accounted for by the seven

Table 4. Stream of communalities indicating linear association between the Principal Components and an individual observed variable.

Variable	Initial	Extraction
Lpc	1.000	0.639
Lds	1.000	0.652
Mkt	1.000	0.635
Mrg	1.000	0.504
Tech	1.000	0.577
Ftr	1.000	0.725
Cra	1.000	0.641
Fp	1.000	0.572
Atc	1.000	0.740
Ag	1.000	0.589
Ed	1.000	0.742
Lta	1.000	0.612
Ec	1.000	0.711
Fdi	1.000	0.574
Ofe	1.000	0.986
Fh	1.000	0.676
Fex	1.000	0.987

Source: Analysis of Field Data, 2004.

principal components.

Linear association of observation variables and PCs

Table 4 indicates the stream of communalities or communality per indicant, which is an outcome of the linear association with their common factors. It shows that 64% of the variation in land per capita was accounted for by the seven common factors. The remaining 36% is explained by unique factor. Also 65, 64, 50, 58%, etc in that order indicate the levels of variation in leadership status, market access, membership of rural groups, etc respectively that were subsumed in the seven common factors or accounted for by the seven principal components.

Conclusion

The result of the principal component extraction process indicates that the highest subsumed indicants with the factor loadings are conservation technology (0.824), education (0.920), woodland/forest dependency for income (-0.610), membership of rural group (0.563), dependency on fuel wood for livelihood (-0.613), economic orientation of the people (0.493) and credit access (-0.561) for PC1, PC2, PC3, PC4, PC5, PC6 and PC7 respectively. Furthermore, the non-zero loadings on each of the seven principal components indicate that every variable in the set shares something in common. This explains that for PC1, the hypothesized set of institutional factors affect one indicant as it affects other parameters in the farmers' decision to clear or not to clear woodland for arable cropping; hence the term, common factor.

This finding led to the rejection of the hypothesis which states that farmers' behaviour, characteristics, institution and infrastructure parameters do not act interwovenly to influence farmers' choice of woodland conversion to arable cropping. Data behaviour sign-wise and magnitude-wise also indicate that more than one set of hypothetical factors are involved in the interaction between the indicants. By exploratory factor analysis technique, data reduction was achieved and nature of interaction investigated and confirmed. Therefore, this study has revealed linkages and linear associations between farmers' characteristics and their decision parameters in the woodland conversion equation and this indicates that different levels of interdependency among variables that affect woodland conversion to arable cropping exist. Thus, the hypothesis which states that farmers' behaviour, characteristics, institution and infrastructure parameters do not act interwovenly to influence farmers' choice of woodland conversion to arable cropping is rejected. The findings also indicate that policies that will improve the off-farm employment status of the farmers will also improve their economic orientation (reduce poverty level), benefit conservation programme, and reduce woodland/forest dependency for livelihood. Such policies will also provide opportunity for the farmers to access improved technologies without much emphasis on financial credit.

REFERENCES

Adegboye RO (1984). "The need for land reform in Nigeria" J. Econ. Soc. Stud., 28:
Adger WN, Brown K (1994). Land use and the causes of Global warming: John Willey press, Baffrins Lane, Chuster, England.
Boserup E (1985). "Economic and Demographic Interrelationship in sub Sahara African", Population and Development Review, London.
Colchester M, Lohmann L (1993). The struggle for the land and the fate of the forest, Zed Books, London
Eboh EC (1999). "Problem Definition, Theoretical and Conceptual Framework, Statement of Objective, Research Questions and Hypotheses formulation in Technology Policy Research", Invited paper presented at the African Technology Policy Studies (A TPS) Net work, Nsukka, Nigeria, January.
Eboh EC, Lemchi JI (1994). "Population Pressure and Indigenous Land Tenure in Eastern Nigeria: Implications for Land Administration and Titling". J. Rural Dev. Administr., 24(3): 67-77.
FAO (2007). State of the World's Forest, FAO Rome.
FAO (2003). State of the World's Forest, FAO Rome.
FAO (2000). State of the World's Forest, FAO, Rome.
FAO (1997). State of the World's Forest, FAO, Rome
NBS (2008). National Bureau of Statistics, 2008 Publications, Abuja, Nigeria.
Jeon N, Charles WM (1978). Introduction to Factor Analysis: what it is and How to do it, Sage publications, Newbury Park, London, New Delhi.
Mather AS (1990). Global Forest Resources, London, Belhaven.
NPC (2006), National Population Commission, Nigeria Population Census.
Richards JF (1990). "Land Transformation, In: Turner BL, dark WC,

Kates RW, Richards JF, Mathers JT, Myers WY (eds). The earth as transformed by Human Action, Cambridge, Cambridge University press.
Rivkin MD (1986). Land Use and the Intermediate Size City in Developing Countries, New York.
Rudel TK (1993). Tropical Deforestation: small Farmers and Local clearing in the Ecuadorian Amazon. New York, Colomba University Press.
Shepherd A, Shark E, Itobley M (1993). In: Simon R (ed.), Tropical Forest, Earthscan publications Ltd London.
Stietenroth D, Lorenz W, Tarigan S, Malik A (2005). Proceedings: International Symposium “The Stability of Tropical Rainforest Margins: Linking Ecological, Economic and Social Constraints of Land Use and Conservation”, Georg-August-University of Goettingen (September 19-23, 2005)
Thurstone LL, Mueller C (1979) Multiple Factor Analysis, 6th edition Chicago, University of Chicago Press
WRI (1994). World Resources Inventory 1992-1993 Earthscan Publication Ltd. London.

Appendix 1

		Lpc	Lds	Mka	Mra	Tech	Ft	Cra	Fp	Atc	Ag	Ed	Lta	Ec	Fdi	Ofe	Fh	Fex
Correlation	**Lpc**	**1.000**	**.076**	**-.112**	**-.059**	**-.046**	**-.139**	**.273**	**-.085**	**.092**	**-.159**	**.000**	**.087**	**.102**	**-.172**	**-.037**	**.250**	**.275**
	Lds	.076	1.000	.382	.030	.219	-.026	.254	-.131	-.364	-.363	-.020	.146	-.265	.080	-.069	-.183	-.120
	Mkg	-.112	.382	1.000	.177	.308	.109	.343	.184	-.262	-.138	.098	-.029	-.039	.242	.143	-.330	-.109
	Mrg	-.059	.030	.177	1.000	.027	-.285	.110	-.035	.044	.154	.271	-.023	-.031	.258	.007	-.027	.114
	Tech	-.046	.219	.308	.027	1.000	-.078	.192	.091	-.242	-.024	-.011	.104	-.333	.360	-.040	-.175	-.078
	Ft	-.139	-.026	.109	-285	-.078	1.000	-.173	.080	-.191	.001	-.048	.316	.144	-.018	-.044	-.300	-.212
	Cra	.273	.254	.343	.110	.192	-.173	1.000	.095	.445	.163	.085	-.030	-.176	.125	-.055	-.455	.323
	Fp	-.085	-.131	.184	-.035	.091	.080	.095	1.000	-.008	.190	.050	.122	-.212	.054	-.181	.051	-.049
	Atc	.092	-.364	-.262	.044	-.242	-.191	.445	-.008	1.000	.284	.079	-.230	.363	-.033	.045	.587	.547
	Ag	-.159	-.363	-.138	.154	-.024	.001	.163	.190	.284	1.000	.075	-.013	.069	-.067	-.066	.182	.212
	Ed	0.000	-0.02	0.098	0.27	-0.01	-.048	0.085	.050	.079	.075	1.000	-.105	-.011	.250	-.100	.080	-.216
	Lta	-0.09	0.15	-0.03	-0.02	0.104	.316	-.030	.122	-.230	-.013	-.105	1.000	-.048	-.113	-.097	-.181	-.225
	EC	0.102	-0.27	-0.04	-0.03	-0.33	.144	-.176	-.212	.363	.069	-.011	-.048	1.000	-.047	.135	.139	.160
	Fdi	-0.17	0.08	0.24	0.26	0.36	-.018	-.125	.054	-.033	-.067	.250	-.113	-.047	1.000	.104	-.012	.003
	Ofe	-0.04	-0.07	0.14	0.007	-0.04	-.044	-.055	-.181	.045	-.066	-.100	-.079	.135	.104	1.000	.007	.056
	Fh	0.25	-0.18	-0.33	-0.03	-0.18	-.300	.455	.051	-.587	.182	.080	-.181	.139	-.012	.007	1.000	.331
	Fex	0.28	-0.12	-0.11	0.114	-0.08	-.212	.323	-.049	.547	.212	-.216	-.225	.160	.003	.056	.331	1.000

Appendix 2

		Lpc	**Lds**	**Mka**	**Mra**	**Tech**	**Ft**	**Cra**	**Fp**	**Atc**	**Ag**	**Ed**	**Lta**	**Ec**	**Fdi**	**Ofe**	**Fh**	**Fex**
Single (1-tailed)	**Lpc**		**.258**	**.170**	**.307**	**.347**	**.116**	**.009**	**.233**	**.215**	**.087**	**.500**	**.230**	**.193**	**.070**	**.375**	**.015**	**.008**
	Lds	.258		.000	.399	.029	.413	.014	.132	.001	.001	.431	.106	.011	.249	.278	.058	.152
	Mkg	.170	.000		.064	.004	.175	.001	.057	.012	.119	.201	.401	.370	.018	.110	.002	.175
	Mrg	.307	.399	.064		.408	.007	.173	.383	.354	.094	.009	.421	.395	.013	.477	.408	.165
	Tech	.347	.029	.004	.408		.253	.050	.218	.018	.420	.462	.188	.002	.001	.368	.067	.254
	Ft	.116	.413	.175	.007	.253		.069	.247	.050	.498	.342	.003	.108	.440	.354	.004	.034
	Cra	.009	.014	.001	.173	.050	.069		.208	.000	.081	.234	.400	.065	.143	.319	.000	.002
	Fp	.233	.132	.057	.383	.218	.247	.208		.473	.051	.334	.148	.034	.323	.060	.332	.339
	Atc	.215	.001	.012	.354	.018	.050	.000	.473		.007	.250	.024	.001	.390	.349	.000	.000
	Ag	.087	.001	.119	.094	.420	.498	.081	.051	.007		.261	.457	.278	.285	.285	.059	.034
	Ed	.500	.431	.201	.009	.462	.342	.234	.334	.250	.261		.185	.463	.015	.197	.249	.031
	Lta	.230	.106	.401	.421	.188	.003	.400	.148	.024	.457	.185		.341	.166	.204	.060	.026
	EC	.193	.011	.370	.395	.002	.108	.065	.034	.001	.278	.463	.341		.344	.124	.118	.085
	Fdi	.070	.249	.018	.013	.001	.440	.143	.323	.390	.285	.015	.166	.344		.188	.461	.490
	Ofe	.375	.278	.110	.477	.368	.354	.319	.060	.349	.285	.197	.204	.124	.188		.478	.316
	Fh	.015	.058	.002	.408	.067	.004	.000	.332	.000	.059	.249	.060	.118	.461	.478		.002
	Fex	.008	.152	.175	.165	.254	.034	.002	.339	.000	.034	.031	.026	.085	.490	.316	.002	