FOREST PRODUCT EXPORT PERFORMANCE IN TROPICAL AFRICA: AN EMPIRICAL ANALYSIS

DASTAN BAMWESIGYE, FRANCIS NMADABUCHUKWU AKWARI, PETRA HLAVÁČKOVÁ

ABSTRACT
Africa is endowed with enormous forest resources, largely hardwood species. This forest resource provides the region with various forest functions ranging from market to non-market products and services. Over the years, demand for African hardwood and products has increased, thus contributing to the economic performance of particular nations. The forest sector in most Tropical African countries provides vital export value, some of which is not fully quantified. The export value of the forest sector in the designated countries of Nigeria, Kenya, Democratic Republic of Congo, Uganda, and Tanzania is enormously reliant on three products. The goal of the study was to examine and explain the relationship between the contributions of the selected forestry products: industrial round wood and non-coniferous, wood pulps and sawn wood, and the export performance of the overall forestry sectors in the selected countries from Tropical Africa. The research carried out various diagnostic examinations grounded on pooled ordinary least-squares (OLS) residuals. The three wood products were found to have a vital influence on the overall export significance of the entire forestry sectors for the region. Industrial round wood was found to be positively significant in terms of export value.

KEY WORDS
Africa, export value, forest production, hardwood, Heteroskedasticity.

DOI: 10.23762/FSO_VOL7_NO1_5

DASTAN BAMWESIGYE[1]
e-mail: bamwesigyedastan@gmail.com

FRANCIS NMADABUCHUKWU AKWARI
e-mail: xnmadabu@node.mendelu.cz

PETRA HLAVÁČKOVÁ
e-mail: xhlavac5@mendelu.cz
Mendel University in Brno, Czech Republic

[1] Corresponding author

Introduction

Africa is endowed with vast forest resources (Bamwesigye and Hlaváčková, 2017) which have provided the region with various forest functions ranging from market to non-market products and services (Bamwesigye et al., 2017; Bamwesigye and Hlaváčková, 2017; Klemperer, 2003). For decades, Africa – and in particular Tropical Africa – has been a global leader in the production and trade of hardwood species (Bamwesigye et al. 2018). Their study outlines numerous types of hardwood, including African ash (Pterygota macrocarpa), African mahogany (Khaya grandifoliola), African Teak (Chlorophora excelsa), fzelia (Afzelia bipindensis), Utile

Paper received: 10 November 2018 • Paper revised: 11 January 2019 • Paper accepted: 31 January 2019

(Entandrophragma utile), Afrormosia (Pericopsis elata), and African Cherry (Prunus africana) among others.

Upon production, these species join the broad market of wood timber products such as sawlogs, industrial round woods and non-coniferous, printing sawn wood and wood pulp, wood fuel and charcoal, and wood pellets (Jonsson et al. 2015). This is necessary for understanding broad market issues and their implications (Nunes et al., 2018).

Most studies have focused on finished goods of forest products such as paper, pulps, and chemical wood (Hurmekoski and Hetemaki, 2013). Equally important is that most studies have paid attention to trend and impact analysis, and less attention to forest products' performance on the international market (Popp et al. 2018) and the potential impact on economy, livelihood, and environment (Androniceanu and Popescu, 2017; Androniceanu and Drăgulănescu, 2016; Kliestik et al., 2018b). Understanding the performance of forest products in the forest sector is not only paramount for national economic growth in terms of rating which sectors contribute the most or least, but it is also important for the economic perspective of forestry economics such as competitiveness in the market (Dieter and Englert, 2007; Hurmekoski and Hetemaki, 2013).

Both investigations illustrate the competitiveness on the global market, with major concepts such as comparative advantage (Oláh et al., 2018; Kliestik et al. 2018a), constant market share, commodity-composition effect, the world growth effect, and lastly residual. Their studies of raw wood, semi-finished wood products, and finished wood products in Russia, Finland, and Poland demonstrate the significance of the cross-border wood trade, most importantly in terms of the competitiveness and comparative advantage of a nation. Moreover, their investigations showed a strong positive relationship between Germany's wood timber export growth rate and the effect on competitiveness.

The international trade in wood has not been without shortcomings. There is a notion that wood trafficking and smuggling exist on a global scale. For example, in 2009 and 2010, it is estimated that over 1500 containers of wood worth millions of dollars were illegally authorised for export from Madagascar, which contravenes international regulations (Sharife and Maintikely, 2018).

Given the deliberations presented, the objective of this research is to investigate the relationship between the contributions of selected forestry products (e.g. industrial round woods and non-coniferous, sawn wood and wood pulp) and the export performance of the overall forestry sectors in the selected countries.

1. Literature review

The African forestry sector is a fundamental cog in the dynamics of trade and development for the region (Food and Agriculture Organisation 2009; Bayol et al., 2012; Lukumbuzya and Sianga, 2017). It goes without saying that African countries have a continual ongoing history of forest management, with a multiplicity of countries recording their fair share of successes and failures. Additionally, Africa is home to a number of vast forest systems. For example, the Congo Basin is the second-largest tropical rainforest in the world (Bayol et al., 2012). Trade in forestry products is a critical conscript of the ever-busy African trade routine, with a number of wood and non-wood forestry products featuring in both intra- and extra-continental trade. Similarly, the Food and Agriculture Organisation (2009) stated that annual primary and secondary wood product exports resulting from tropical forests had exceeded US$20 billion. In fact, the main export destinations of Africa's forestry sector products are dominated by China, the European Union and Asia (Bayol et al. 2012).

Africa therefore represents one of the leading forestry sector performers in the world, continuously providing a number of products to the global market. Furthermore, these figures are expected to increase given the increased intensification of the export of higher quality wood products from even more African countries. To elaborate, Bahanak and Yves (2014) noted that as of 2007 Central African forestry sectors produced nearly 9 million m^3 of logs for export only. For example, Gabon is the largest log producer in the Congo basin, with an annual production of 3 million m^3 (Bayol et al., 2012). The regional trade in natural forest timber from East and Southern Africa is also increasing (Lukumbuzya and Sianga, 2017). In fact, the income estimates from this trade represent hundreds of millions of dollars over the last ten years. Similarly, a report by the Ministry of Industry and Trade (2014) noted that forestry made up over 3.3% of Tanzanian GDP per annum, with forest goods accounting for USD 2.2 billion per year.

After the collapse of apartheid, the demand for South African wood chips on the international market became significantly higher. The Department of Labour South Africa (2008) further states that the export value of wood chips grew at an annual rate of 18.2% from 1994 to 2002. The main export destination of the wood chips is primarily Japan, which purchased 98.6% of all South Africa's wood chip exports between 2003 and 2006. However, this also actuates another issue of fluctuating exchange rate changes affecting trade. The fact that the export market is limited almost exclusively to Japan - and is therefore rather constricted - means that this trade is sensitive to varying exchange rates, with a recorded reduction in wood chips value of 3.1% following the appreciation of the rand between 2003 and 2006. Ultimately, the wood chipping sector has since established itself as a significant foreign exchange source for South Africa, contributing R2.14 billion and R1.86 billion worth of nominal export income in 2005 and 2006 respectively.

Similarly, the Tanzanian ministry of industry and trade (2014) noted an increase in forest product trade, essentially for wood-based products. The estimated total timber exports were noted to have been at over 250,000 m^3 annually, a staggeringly promising figure. This was attributed to the effective increment in sawn wood exportation, thus envisaging the projected continuous prosperity of trade in forest products for Tanzania. The primary export destinations for Tanzania's sawn wood necessarily include the European Union, Japan, and China. According to reports, Kenya represented the largest domestic importer of Tanzania's timber exports with a staggering 67% importation rate, specifically for sawn timber. Similarly, India was the leading export destination on the international scene. Furthermore, exportation of utility poles was observed to have increased from 905 to 31,200 poles from 2004 to 2008 (Ministry of Industry and Trade, 2014). The final products are exported to international markets, with a variety of nations having a high level of market interest in these products. In due course, on the domestic scene, Kenya, Uganda, Malawi, and Zambia take centre stage as the penultimate export destination of Tanzania's paper sector products (Ministry of Industry and Trade, 2014). International exportation is dominated by the markets of India, Sri Lanka, Bangladesh, Malaysia, Vietnam, Iran, Egypt, and Saudi Arabia. According to this report, an assessment of the artisanal wood industry revealed that by 1999 export revenue generated from this sector amounted to a staggering US$ 1.1 million. In effect, this translated to over 30% of the total export value of forest products from Tanzania. The most marketable products from this sector include black-wood pieces and wood carvings.

Domson (2007) stated that the Ghanaian forestry sector had undergone major expansion with regards to the exportation of wood products. Wood trade is a booming financial activity for the country, accounting for about 60% of the nation's total export earnings.

A case study of Uganda, where 24% of the total land is covered by forests, presented interesting figures on the state of the export performance of the overall forestry sectors in the country. The forestry sector is definitely a critical component of the Ugandan economy, generating a substantial amount of the country's total GDP. The total annual production of round wood timber was projected at 34.4 million tons by 2007, a substantial increase on the 29.2 million tons recorded in 2003 (National Forestry Authority Uganda, 2007). In point of fact, of this aggregation, sawn wood production for export also grew from 791,000 tons to 1 million tons between 2003 and 2007.

Finally, an empirical analysis of the main features of the export performance of forest products of six sub-Saharan Africa nations by Lukumbuzya and Sianga (2017) provides interesting results. The Democratic Republic of Congo is the leading exporter of forest products in the region, with Kenya being of little to no significance in terms of the export trade dynamic of the region. Also, Tanzania is an active exporter of natural forest hardwood timber in East Africa, with solid sawn wood being the most exported product as of 2013. Similarly, Kenya lacks a resounding presence as far as the exportation of forest products is concerned. However, it is the largest importer of forest products, particularly hardwood, in East Africa.

2. Materials and methodology

Data on timber production from various data banks such as The Food and Agricultural Organisation (FAO) FAOSTAT (2018) was used in the study, which also attained significant information from various scientific bases such as journal articles, scientific conference proceedings, and web pages. However, balanced panel and secondary data for the period from 2010 to 2015 randomly selected from five African countries (Nigeria, Kenya, Democratic Republic of Congo, Uganda, and Tanzania) was used for the research analysis.

The economic variables included the export share of selected forestry products (i.e. industrial round wood and non-coniferous, sawn wood and wood pulp) and the overall export values of the forestry sector. The total export share of the selected forestry product is used as a proxy for the contribution of each and every forestry product to the overall export of the forestry sectors, and the overall export value is used as the proxy for the export performance of the forestry sector. The study used 30 observations based on the chosen variables and the availability of data, since there was a limitation of missing data for some years, products, as well as countries respectively.

The research design is Ex-Post factor or correlational as the data is quite difficult to manipulate and very easy to compute. The research is also descriptive and inferential in nature. The study carried out numerous diagnostic examinations based on the pooled ordinary least-squares (OLS) model.

Model estimation

Model 1: $EXP_{it} = \beta_0 + \beta_1 IRWNI_{it} + \beta_2 SW_{it} + \beta_3 WP_{it} + \varepsilon_{it}$

Model 2: $InEXP_{it} = \beta_0 + \beta_1 InIRWN_{it} + \beta_2 InSW_{it} + \beta_3 InWP_{it} + \varepsilon_{it}.$

Model 3: $EXP_{it} = \beta_0 + \beta_1 InIRWN_{it} + \beta_2 InSW_{it} + \beta_3 InWP_{it} + \varepsilon_{it}$

Where:

IRW represents: Industrial round woods
SW represents: Sawn wood
WP represents: Wood pulp
EXP represents: Export value

3. Results and discussion

Diagnostic Tests: The model passes the diagnostic test by meeting the classical assumptions for the ordinary least square estimator. The results of the diagnostic test are shown herein.

The investigation carried out several diagnostic examinations based on pooled ordinary least-squares (OLS) residuals. These consist of:

White Test of Heteroskedasticity: Heteroskedasticity presents itself when given error terms such as a lack of constant variance. In this case, heteroskedasticity might arise given the number of implications including increases in the value of instrumental variables which ultimately lead to increased errors (White, 1980). Similarly, extremities in instrumental variable values in either direction also increase errors, such as when dealing with values ranging from extreme negative to positive. Finally, measurement errors can similarly factor for heteroskedasticity, resulting in data flaws. In this case, this causes bias to statistical and confidence interval tests, thus presenting biased and misleading estimates (White, 1980).

Moreover, it is imperative for researchers to carefully account for detecting heteroskedasticity to ensure the authenticity of their research. In effect, therefore, a number of tests exist purposely to identify and potentially correct heteroskedastic effects, including but not limited to the White test of heteroskedasticity. Halbert White (1980) first proposed the test which appeared as a variant of Breusch-Pagen given the similarities. The test occurs as a general test for heteroskedasticity, given that it does not adapt to normal assumptions and is normally easier to implement (White, 1980).

Likewise, Ullah (2016), suggests the calculation of R2 to enable an analysis of the statistical significance of n×R2~χ2df, following the null hypothesis of no heteroskedasticity. Finally, the hypothesis of no heteroskedasticity is rejected in favour of the presence of heteroskedasticity, provided the critical chi-square value at the chosen level of significance is lesser than the analysed chi-square value.

Result of White Test of Heteroskedasticity

H_o: Heteroskedasticity is not present.

H_a: Heteroskedasticity is present

The p-value is 0.45. The decision rule is that we do not reject the null hypothesis at a significance level of 5%. Therefore, the errors of the model are free of heteroskedasticity.

Result of multicollinearity test.

VIF(InIRWNC) = 2.232.

VIF(InSW) = 1.789

VIF(InWP)= 1.533

Since the variance-inflated factors of the above economic variables are less than 10, there is no issue with multicollinearity among the independent variables.

Cross-Section Dependence: Cross-section dependence is usually an eventuality of results from the spatial approach (Sarafidis and Wansbeek 2011). In fact, the occurrence of cross-section dependence has been attributed to a number of reasons, not limited to but including non-random sampling and overlooked upsets (Basak and Das, 2018). Cross-sectional dependence is critical for panel data analysis, and one of the earliest methodologies used in addressing this issue was the spatial approach. Therefore, the adoption of distance matrices allowed for the replication of time index structures resulting from the formulation of models that allowed such flexibility (Sarafidis and Wansbeek, 2011).

Result of Pesaran CD Test for Cross-Sectional Dependence.

H_o: There is no cross-sectional dependence

H_a: There is cross-sectional dependence

The p-value is 0.55. The decision rule is that we do not reject the null hypothesis at a significance level of 5%. Therefore, there is no cross-sectional dependence among the error terms

Result of Ramsey RESET Test for Model Specification

The p-value is 0.914. The decision rule is that we do not reject the null hypothesis at a significance level of 5%. Therefore, the model is correctly specified.

Result of Durbin Watson Auto-correlation Test

The p-value is 0.063. The decision rule is that we do not reject the null hypothesis at a significance level of 5%. Therefore, there is no autocorrelation among the error terms.

Table 1. Adjusted R-squared

SN	FORM FUNCTION	ADJUSTED R-SQUARED	AIC	HIC	SIC
1	LINEAR	0.66	753	754	758
2	LOG-LOG	0.75	58	60	64
3	LINEAR-LOG	0.57	760	762	765

Source: Own elaboration.

The second model is selected based on the fact that it has the highest value of Adjusted R-squared and lowest values of Akaike, Hannan Quinn, and Schwarz criteria (Table 1).

Table 2. Descriptive statistic summary

Variables	InEXP	InRWNC	InSW	InWP
Mean	10.846	9.0430	8.2827	4.3296
Median	10.911	8.8681	8.3813	4.2691
Maximum	12.890	12.816	10.765	6.3630
Minimum	8.9561	5.8051	4.8363	2.8904
Std dev	1.1952	2.1546	2.0122	0.84205
Coefficient.Var	0.11019	0.23826	0.24294	0.19448
Skewness	-0.039424	0.10831	-0.22603	1.1355
kurtosis	-0.98482	-1.2540	-1.4250	1.2539
Observation	30	30	30	30

Source: Own elaboration using Gretl statistical software.

The values of the mean and the median are between the maximum and the minimum values. This very clearly shows the consistency of the data of all economic variables (Table 2). The standard deviations are high, which signifies the high level of volatility of the variables. Two of the variables such as the natural log of the export value and the sawn wood export share have negative skewness. This shows that the distributions of the variables are negatively skewed to the left. However, the other variables such as the natural log of industrial round woods export share and wood pulp export share are positively skewed. This implies that the distributions of the variables are positively skewed to the right. Some of the distributions of the variables (e.g. the natural log of export value, industrial round woods export and sawn wood export share) are platykurtic as they have negative excess.

Correlational Matrix

Table 3. Correlation Coefficient Matrix

Variables	lnEXP	lnRWNC	lnSW	lnWP
lnEXP	1	-	-	-
lRWNC	0.82	1	-	-
lnSW	0.67	0.56	1	-
lnWP	0.41	0.45	-0.064	1

Source: Own elaboration using Gretl statistical software.

Table 3 illustrates a strong and positive correlation between the export value and the industrial round woods export share. The correlation between the export value and sawn wood export share is strong and positive, and the correlation between export value and wood pulp export share is weak and positive. In addition, the correlation between industrial round woods export share and sawn wood export share is moderate and positive, and that between the industrial round woods export share and WP is weak and positive. Finally, the correlation between the sawn wood export share and wood pulp export share is weak and negative.

Ordinary Least Squares; Ordinary least squares (OLS) is among the more popularly adhered-to methods of multivariate analysis. In fact, one of the fundamental aspects of OLS is that it provides researchers with the liability of factoring for the possibility of errors between dependent and descriptive variables (Anselin, 2015). OLS, in effect, is therefore a linear regression model, with an important aspect of presenting unbiased forms of analysis. Moreover, OLS offers statistical solutions that facilitate an easier understanding of linear relationships linking different variables through simple analysis and modelling (Anselin, 2015; Moravcikova et al., 2017).

In use, therefore, the most basic version of OLS according to Anselin (2015) usually aims to reduce the number residual sum of squares (RSS).

The multiple regression equation is given as:

$$InEXP_{it} = 5.04 + \ 0.277InIRWN_{it} + 0.24InSW_{it} + 0.30InTO_{it} + \varepsilon_{it}.$$

From the analysis, the intercept co-efficient is 5.04. This implies that the average export of forestry products stands at $504, provided there is no export of the three forestry products.

The partial co-efficient of the natural logarithm of IRWN is 0.277 while holding other variables constant (Table 2). This implies that a 1% increase in the export of IRWN leads to a 0.28% increase in the export of forestry products on average. As the partial coefficient of the natural logarithm of IRWN is positive and significant at the 5% level of significance, it implies that the export of IRWN has a positive and significant relationship with the export performance of the forestry sector at the 5% significance level. Also, the partial coefficient of the natural logarithm of SW is 0.24 while holding other variables constant. This implies that a 1% increase in the SW leads to a 0.24% increase in the export of forestry products on average.

The partial coefficient of the natural logarithm of SW is positive and significant based on its p-value. It implies that there is a positive and significant relationship between the export of SW and export performance in the forestry sector. In addition, the partial coefficient of the natural logarithm of WP is 0.30, holding other variables constant. This implies that a 1% increase in the WP leads to a 0.30% increase in the export performance of the forestry sector on average. The partial coefficient of the natural logarithm of WP is positive, but not significant. The two most vibrant exports of forestry products are IRWN and SW.

Table 4. Regression Estimate Result

Method: Pooled Ordinary Least Square (i.e. OLS)
Dependent Variable: lnEXP.
Sample Size: 30
Cross-sectional Units: 5

Variable	Coefficient	Standard Error	T-Ratio	P-Values
Constant	5.03921	0.779194	6.467	7.46****-07
lnIRWN	0.276975	0.0776110	3.569	0.0014
lnSW	0.241538	0.0744070	3.246	0.0032
lnWP	0.300676	0.164555	1.827	0.0792

R-Squared: 0.771974 F (3, 26): 29.34061
Adjusted R-squared: 0.745663 P-Value (F): 1.67****-08

Source: Own elaboration.

The coefficient of determination (i.e. R^2) is 77%. This implies that 77% of the variation in export performance is explained by variables of the model; while the remaining 23% of the variation in export performance is explained by other factors or variables (Table 4).

Nigeria and DRC take the lead in the export of both industrial round woods and non-coniferous, sawn wood and wood pulp. Kenya, Uganda, and Tanzania registered lower amounts of wood products export. This could also be attributed to other factors such as the size of the countries, for example DRC being more than ten times bigger than Uganda, and of course Nigeria being far bigger than the four other countries in the study.

Our study is in tandem with an analysis of the export performance of forest products among six studies in sub-Saharan Africa nations (Lukumbuzya and Sianga, 2017). Consequently, the Democratic Republic of Congo (DRC) was found to be the leading exporter of forest products in the region, with Kenya the least significant in terms of the export trade in the region.

Conclusions

The research study investigates the relationship between the contributions of selected forestry products, i.e. industrial round woods and non-coniferous, sawn wood and wood pulp, and the export performance of the overall forestry sectors in selected countries from Tropical Africa.

The study also found out that there is a correlation between the export value and sawn wood export share, which is strong and positive. There is also a correlation between export value and wood pulp export share which is weak and positive. The relationship between the industrial round woods export segment and sawn wood export share is moderate and positive, and that between industrial round woods export and WP is weak and positive. In conclusion, the correlation between sawn wood export share and wood pulp export share is weak and negative.

Industrial round wood and non-coniferous (IRWN), wood pulps (WP) and sawn wood (SW) are found to have a paramount effect on the overall export value of the entire forestry sectors for the different countries. Industrial round wood and non-coniferous and sawn wood are found to have positive and statistically significant effects on the overall export performance of the forestry sectors in the selected countries; however, wood pulps have a positive yet statistically insignificant relationship to overall export performance. The variables in the model illustrated a very high percentage, at 77% of coefficient. This means that the export value of the forest sector in the selected countries, Nigeria, Kenya, Democratic Republic of Congo, Uganda, and Tanzania, is hugely dependent on these three products.

The forest sector in most Tropical African countries provides vital export value, some of which is not fully quantified. Apart from the production and export of timber and wood products, there is also a remarkable export value obtained from both wood and non-wood forest products and services.

There should be investment in public infrastructure such as road construction and power generation facilities to boost productivity and efficiency in these sectors, and the provision of incentives for foreign investors, especially tax relief incentives to attract foreign direct investment in the forestry sectors, and solid environment protection policy and implementation mechanisms to maintain the sustainability of forest resources. We recommend that future studies should focus on the net value exports of the forest sector for individual countries and regional levels as well.

References

Androniceanu, A., Popescu, CR. (2017), An inclusive model for an effective development of the renewable energies public sector, Administrație și Management Public, (28): 81-96.

Androniceanu A., Drăgulănescu, I.V. (2016), Survey on the buyers' eco-responsibility and the urban white pollution, Environmental Engineering and Management Journal, 15(2): 481-487.

Anselin, L. (2015), Ordinary least squares and poison regression models, available at: https://illinois.edu. (accessed 10 July 2018).

Bahanak, N., Yves, I. (2014). The state of production and export of timber in the Congo basin: Opportunities and challenges, available at: https://www.giz.de/en. (accessed 15 June 2018).

Bamwesigye, D., Hlaváčková, P. (2017), The non-wood forest value of Bwindi impenetrable forest, Uganda, Conference proceedings from International Scientific Conference "Public recreation and landscape protection – with nature hand in hand", Brno, 2nd-4th May 2017, Mendel University in Brno.

Bamwesigye, D., Boateng, K.A., Hlaváčková, P. (2018), Timber and wood production in tropical African virgin forests, Conference proceedings from International Scientific Conference "Public recreation and landscape protection – with nature hand in hand" (pp. 396-400), Brno, 2nd-4th May 2018, Mendel University in Brno.

Bamwesigye, D., Darkwah, S. A., Hlaváčková, P., Kupcak, V. (2017), Firewood and charcoal production in Uganda, 17th International Multidisciplinary Scientific GeoConference SGEM 2017, Vienna, 17: 521-528. DOI:10.5593/SGEM2017H/33/S14.065

Basak, G.K., Das, S. (2018), Understanding cross-sectional dependence in panel data, SSRN Electronic Journal, 1-27. DOI: 10.2139/ssrn.3167337.

Bayol, N., Demarquez, B., Atyi, R., Fisher, J., Nasi, R., Pasquier, A., Rossi, X. (2012, Forest management and the timber sector in Central Africa, Forest Ecology and Management, 349: 43-61.

Department of Labor South Africa (2008), A sectoral analysis of wood, paper, pulp industries in South Africa, Johannesburg, South Africa: Department of Labor South Africa.

Dieter, M., Englert, H. (2007), Competitiveness in the global forest industry sector: An empirical study with special emphasis on Germany, European Journal of Forest Research, 126(3): 401-412. DOI: 10.1007/s10342-006-0159-x.

Domson, O. (2007), A strategic overview of the forest sector in Ghana, Master's thesis, available at: http://www.lfpdc.lsu.edu/. (accessed 10 June 2018).

Food and Agriculture Organization (FAO) (2009), State of the world's forests, available at: http://www.fao.org/docrep/011/i0350e/i0350e00.htm. (accessed 17 June 2018).

FAOSTAT (2018), Food and Agriculture Organization of the United Nations, available at: http://www.fao.org/faostat/en. (accessed 17 June 2018).

Hurmekoski, E., Hetemaki, L. (2013), Studying the future of the forest sector: Review and implications for long-term outlook studies, Forest Policy and Economics, 34: 17-29. DOI:10.1016/j.forpol.2013.05.005.

Jonsson, R., Rinaldi, F., San-Miguel-Ayanz, J. (2015), The global forest trade model, Luxembourg: The European Union. DOI: 10.2788/666206.

Klemperer, D.W. (2003), Forest resource economics and finance, New York: McGraw-Hill.

Kliestik, T., Kovacova, M., Podhorska, I., Kliestikova, J. (2018a), Searching for key sources of goodwill creation as new global managerial challenge, Polish Journal of Management Studies, 17(1): 144-154. DOI: 10.17512/pjms.2018.17.1.12.

Kliestik, T., Misankova, M., Valaskova, K., Svabova, L. (2018b), Bankruptcy prevention: New effort to reflect on legal and social changes, Science and Engineering Ethics, 24(2): 791-803. DOI: 10.1007/s11948-017-9912-4.

Lukumbuzya, K., Sianga, C. (2017), Overview of the timber trade in East and Southern Africa. Traffic, available at: https://goo.gl/omQm9t (accessed 15 June 2018).

Ministry of Industry and Trade (2014), Forest governance and timber trade flows within, to and from Eastern and Southern African countries. Tanzania study, available at: https://D:/Users/Dell/Downloads/final_flegt_study_-_tanzania_feb_2014.pdf (accessed 15 July 2018).

Moravcikova, D., Krizanova, A., Kliestikova, J., Rypakova, M. (2017), Green marketing as the source of the competitive advantage of the business, Sustainability, 9(12): 2218. DOI: 10.3390/su9122218.

Nunes, F. G., Martins, L. M., Mozzicafreddo, J. (2018), The influence of service climate, identity strength, and contextual ambidexterity upon the performance of public organizations, Administratie si Management Public, (31): 6-20. DOI: 10.24818/amp/2018.31-01.

Oláh, J., Sadaf, R., Máté, D., Popp, J. (2018), The influence of the management success factors of logistics service providers on firms' competitiveness, Polish Journal of Management Studies, 17(1): 175-193. DOI: 0.17512/pjms.2018.17.1.15.

Popp, J., Kiss, A., Oláh, J. Máté, D. Bai, A., Lakner, Z. (2018), Network analysis for the improvement of food safety in the international honey trade, Amfiteatru Economic, 20(47): 84-98.

Sarafidis, V., Wansbeek, T. (2011), Cross-sectional dependence in panel data analysis, Econometric Reviews, 31(5): 483-531. DOI:10.1080/07474938.2011.611458.

Sharife, K., Maintikely, E. (2018), The fate of Madagascar's endangered rosewoods, available at: https://www.occrp.org/en/28-ccwatch/cc-watch-indepth/8480-the-fate-of-madagascar-s-endangered-rosewoods.(accessed 10 July 2018).

Uganda Investment Authority (2007), Forestry sector profile, available at: https://goo.gl/kW9xcr (accessed 18 June 2018).

Ullah, M.I. (2016). Basic statistics and data analysis, available at: http://itfeature.com/heteroscedasticity/white-test-for-heteroskedasticity (accessed 20 July 2018).

White, H. (1980), A heteroscedasticity consistent covariance matrix estimator and a direct test of heteroscedasticity, Econometrica, 48(4): 817-81. DOI: 10.2307/1912934.

Dastan Bamwesigye is a Ph.D. candidate at the Department of Forest and Wood Products Economics and Policy, Faculty of Forestry and Wood Technology, Mendel University in Brno, Czech Republic. His research focuses on forestry economics, valuation, and forest function quantification. Even though Dastan studies the determinants of forest development in the region, he is also concerned about the implications of forest exploitation such as forest degradation and deforestation, climate change and food security.

Francis Nmadabuchukwu Akwari is a third-year student of Bachelor of Economics and Management at the Faculty of Business and Economics, Mendel University in Brno. Francis is very much interested in econometrics, informatics, statistics and economic policies.

Petra Hlaváčková is an assistant professor at the Department of Forest and Wood Products Economics and Policy, Faculty of Forestry and Wood Technology, Mendel University in Brno, Czech Republic. Her research focuses on forest economics, valuation, and methodology. She is an expert in forestry and natural resource economics.