（別記様式4）
(Form 4)

学位論文の要旨（論文の内容の要旨）
Summary of the Dissertation (Summary of Dissertation Contents)

氏　　名
Name GIVEN MATOPOTE

学　位　論　文
Dissertation

論　文　題　目

Dissertation Title

Climate Variability, Agricultural Production, and Farmers' Willingness to Seek Financial Assistance in Botswana

Climate variability has become a hindrance to global agricultural production. Thus, studying the relationship between climate variability and agriculture is critical, particularly in the Global South countries, and semi-arid environments, such as Botswana, whose agricultural sectors are dependent on rainfall. As Botswana continues to experience variations in temperature and rainfall, there is a need to study the connection of this to agricultural production. This may assist in the formulation of policies aimed at reducing livestock and crop losses from projected variations in climate in the future. This dissertation establishes associations between climate variability and agricultural production in Botswana at a national level. Using yearly time series data from 1969 to 2020, the study employs vector autoregression with exogenous variables (VARX) and autoregressive distributed lag (ARDL) models to determine the associations between climate variability and agricultural production in Botswana.

Cattle and goats, which are the dominant livestock in Botswana, are used for the VARX analysis, and the climatic variables considered are annual maximum surface air temperature (AMASAT), annual minimum surface air temperature (AMISAT), and dry/wet year (DY/WY). The dryness and wetness of the year are defined based on the standardised precipitation index (SPI). The trend shows that both cattle and goat populations are decreasing. The VARX model results reveal that cattle and goat populations are negatively associated with increasing maximum temperatures. Cattle respond negatively to increased minimum temperatures, as well. Goats tend to respond positively, implying that livestock species react differently to climatic conditions due to their distinct features. The results of the roots of the companion matrix for cattle and goat production meet the stability condition, as all the eigenvalues lie inside the unit circle. The study recommends further intervention by the government to deal with increasing temperatures. This would address the dwindling populations of goats and cattle, which have significant contributions to the household economies of smallholders and the national economy, respectively.

The ARDL and VARX models are used to determine the associations between climate variability and Botswana's most cultivated cereal crops, maize and sorghum. The climate variables used are seasonal maximum surface air temperature (Tmax), seasonal minimum surface air temperature (Tmin), and dry/wet season (DS/WS). The definition of DS/WS is still based on SPI. The trends for both crops indicate that

sorghum outperforms maize, although the production for both crops has fluctuated at low levels. Maize is negatively associated with maximum temperatures and positively with the WS in the long run. Meanwhile, sorghum is positively associated with the DS, maximum temperature, and precipitation in the long run. The results of the VARX model show that precipitation is positively associated with both maize and sorghum production. The relationship between cereal crops and climatic variables might be an indication that the future focus should be on sorghum production.

Based on the vulnerability of the livestock sector to climate variability, government funding on agriculture can form part of the farmers' adaptation strategies. Farmers need finance to deal with climate shocks and expand their farming enterprises. However, certain conditions under which funding is provided can raise or lower the willingness of farmers to seek finance. A cross-sectional survey and vignette experiment were used to examine the effect of vignettes on the willingness of beef cattle farmers to apply for government funding. The vignettes are about Citizenship Entrepreneurial Development Agency's (CEDA's) loan application process, loan interest rates, loan repayment period, collateral provision, and business training. The results from the ordinary least squares (OLS) regression show that the average treatment effect (ATE) coefficients for all the vignettes are positive and significant. The vignette about the interest rates has a larger coefficient than others. This implies that information has a positive effect on farmers' willingness to seek financial assistance. Information about interest rates has a greater effect than others. The study, therefore, recommends that effective information provision to farmers about CEDA's services should be a priority for the wider utilisation of the CEDA funding.

備考　論文の要旨はＡ４判用紙を使用し，4, 000字以内とする。ただし，英文の場合は1, 500語以内とする。

Remark: The summary of the dissertation should be written on A4-size pages and should not exceed 4,000 Japanese characters. When written in English, it should not exceed 1,500 words.