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Road Infrastructure in Rural South Africa: A Spatial Analysis of Road Quality and Regional Inequalities

Infrastructure development, including transport infrastructure, is seen as an important determinant for economic growth. Governments and donor countries invest in both the construction and maintenance of road networks, but developing countries with limited financial resources often struggle to offset deterioration caused by high traffic volumes and weather-related stress, like flooding or extreme temperatures.

In South Africa, public dissatisfaction with road maintenance is very pronounced. According to the Afrobarometer survey (2022), more than half of respondents rated the government's handling of maintenance of roads as very bad. However, there are large regional disparities, both between rural and urban roads and between municipalities. This raises the question: which areas in South Africa are more exposed to road deterioration, and which areas receive more investments for road improvement

This thesis aims to investigate regional differences in road improvement and deterioration, with a focus on characteristics such as ethnic composition of the local population, poorer regions in comparison to richer ones, and if former homelands (territory that was for the black population during Apartheid) are still neglected.

The study employs an innovative methodology that combines economic research with spatial data techniques and machine learning. Google Street View images are used to adapt a road quality prediction model – originally trained on German roads – to the South African context. In a first step, the surface type (e.g. asphalt) is predicted, and then a different model trained exclusively on that surface predicts the quality of the road. This makes a model trained on German roads also suitable for South African roads, as some surface types are more common in one or the other, but roads of the same surface type can be judged with the same criteria. Improved or stable quality indicates investments in infrastructure, while deterioration can be interpreted as insufficient maintenance even though exposed to road damage.

The results are then used to explore spatial patterns in infrastructure development and to assess potential biases, including favoritism toward specific ethnic groups or neglect of poorer areas such as townships and former homelands.

This research aspires to contribute to the economic literature by demonstrating how novel data sources and methods can be used to measure infrastructure quality and analyze spatial inequalities in a developing country context. Because Google Street View is updated regularly, a well-performing model can provide up-to-date information on road conditions and potentially support public authorities with maintenance planning.