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博士論文審査結果報告
Report on Ph.D. / Doctoral Dissertation Defense

National Graduate Institute for Policy Studies (GRIPS)
政策研究大学院大学
Professor MUNRO Alistair

審査委員会を代表し、以下のとおり博士論文審査に合格したことを報告します。

On behalf of the Doctoral Dissertation Review Committee, I would like to report the pass result of the Doctoral Dissertation Defense as follows.

プログラム名 Program	政策分析プログラム Policy Analysis Program
学位申請者氏名（ID） Ph.D. Candidate (ID)	Degenet Shifraw Baue (PHD16101)
Dissertation Title 論文タイトル (タイトル和訳)	Essays on Mapping and Improving Urban Air Quality Monitoring in a Developing Country Setting: The Case of Ethiopia 発展途上国における都市の大気の計測と質の改善策: エチオピアの事例
学位名 Degree Title	博士（開発経済学） Ph.D. in Development Economics
論文提出日/ Submission Date of the Draft Dissertation	2023 年 5 月 9 日/ May 9, 2023
論文発表・審査会開催日/ Date of the Defense and the Doctoral Dissertation Review Committee	2023 年 6 月 13 日/ June 13, 2023
論文最終版提出日/ Submission Date of the Final Dissertation	2023 年 9 月 6 日/ September 6, 2023
審査委員会/ Doctoral Dissertation Review Committee	主査 Main referee: MUNRO Alistair 審査委員 / Referee: 城所　幸弘 / KIDOKORO Yukihiro 審査委員 / Referee: 山﨑　晃生 / YAMAZAKI Akio 審査委員 / Referee: 山田　大地 / YAMADA Daichi, 広島大学 / Hiroshima University 審査委員（博士課程委員会） / Referee (Doctoral Programs Committee): 土谷　隆 / TSUCHIYA Takashi

※ タイトルが英文の場合、文部科学省に報告するため、和訳を付してください

Please add a Japanese title that will be reported to MEXT.

1. Summary of Defense and Evaluation

The dissertation focuses on the important issue of urban air quality which, in sub-Saharan Africa, is a. declining and b. remains poorly monitored. It is specifically focused on Addis Ababa, the fast-growing capital city of Ethiopia and particulate matter (PM).

The major contribution is that, using a low-cost monitoring device (paid for by GRIPS) the student gathered several hundred hours of air quality measurements across Addis Ababa over several months according to a pre-determined research plan. The data was then used to build the first map of air quality for Addis Ababa (and the second such map for sub-Saharan Africa). The map reveals how location and time of day heavily influence the exposure to PM for people living or working in the city. On the basis of the map and its underlying data, the dissertation also develops a method for optimally siting fixed monitors for air pollution in Addis that can also be applied to other countries.

In the defence, held in June 2023, the originality of the data-collection exercise was praised, but the poor quality of the dissertation write-up was criticized. A number of specific criticisms were also made about the calculations of economic value, the data analysis and the transparency of the optimization method. As a result the candidate scored '4'. After further revisions seen by all examiners, a satisfactory version of the dissertation was submitted at the beginning of September, reviewed by the main advisor and approved for submission to GRIPS.

2. Dissertation overview and summary of the presentation.

Poor air quality kills. The World Health Organization estimates that 7-8 million people die prematurely each year due to atmospheric pollution. Despite this, as lower income countries urbanize and development economically there is an almost universal tendency for urban air quality to decline. In order to fix problems of air quality in a sensible manner, one first has to

measure it, but in sub-Saharan Africa and many other parts of the world, there are few fixed monitoring stations for air quality. In many countries, there is just a single monitor, often set up in the leafy grounds of the US Embassy in the capital city. Satellite data provides a potential alternative source of information, but it is currently too broad brush to provide an adequate substitute (and its local accuracy relies on calibrating satellite measurements with on-the-ground readings). As a result, even if a sole monitor is accurate and well-placed it is not possible to generate a city-wide map of air quality for many major cities in Africa.

This dissertation is underpinned by an original data set, gathered by the candidate in order to build a map of an air pollutant in Addis Ababa, the capital city of Ethiopia. It is the first such exercise for Ethiopia and one of only two such exercises in sub-Saharan Africa. To gather the data, the author used a low-cost portable monitor for particulate matter (PM) and moved across the city for several weeks, gathering air quality data from pre-specified sites according to a pre-determined plan. The data represents the most significant contribution of the research.

With the data as input, he has written two 'output' chapters. The first constructs a map for PM2.5 across Addis Ababa. The map is built by relating the PM measurements to time of day, weather variables such as wind direction and rain, as well as to fixed features of local land use, such as high rise buildings and asphalt roads. The major result is that PM2.5 is highly sensitive to time of day, wind direction and land use. Thus an 'average' figure for PM2.5 from a single monitor provides an unreliable guide to exposure to the pollutant for most people living in the city.

The second output chapter takes the results further, first by systematically comparing the candidate's dataset to that from the fixed monitor at the US Embassy and then by considering the question: if people were relying on the nearest fixed monitor for their source of air quality information, what would be the best site for a second fixed monitor in Addis Ababa? Though the exact location is slightly sensitive to assumptions, the candidate generally finds that

the best location is at the centre of the city in a highly urbanized neighbourhood. While this specific conclusion is probably not surprising, the more general take-away is that the dissertation provides a model for how low income countries might usefully create a strategy for urban air quality monitoring.

On the 13th June 2023 Degenet presented a public summary and defence of his work to four members of the Committee (one person was unable to attend but had previously read the dissertation and offered comments). After a 45 minute presentation and questions/comments that lasted for a similar period, the committee retired to make its decision.

3. **Evaluation Notes from the Doctoral Dissertation Review Committee (including changes required to the dissertation by the referees)**

The committee praised the endeavour and originality of the data-gathering exercise. They acknowledged this important contribution to knowledge. At the same time, they also pointed to the very large number of errors, typos, formatting problems, repetitions, obscurities and omissions that dog each part of the dissertation. There were also some clear mistakes in the calculation of economic values or costs due to PM2.5 in Addis Ababa. As a result, the median score was 4. Specific changes required included: for the maps and simulation, focusing on the inner-sub cities of Addis Ababa rather than the whole metropolis; correcting the valuation mistakes; dropping highly collinear variables from the regression models; searching for models with better predictive power; redoing the optimization exercise in the final research chapter.

4. **Confirmation by the Main Referee that changes have been done to the satisfaction of the referees and final recommendations**

About 10 weeks after the defence, the candidate submitted a revised version of the dissertation along with a point by point guide to the changes made. All referees awarded the revised dissertation a '5', but two referees also made requests for additional changes to be made under the supervision of the main advisor. Several referees referred to the continuing large number of minor errors that remained. After two further rounds of revisions checked by the main advisor, the candidate submitted a further revision to the main advisor on the 2nd September which was deemed acceptable. A plagiarism check did not reveal any significant issues. The dissertation review committee therefore recommends that Degenet Shifraw Baue be awarded the degree in PhD in Development Economics.