Empirical Evaluation of Spatial, Connectivity, Urban Structure, Density and Firm Productivity: Evidence from Kampala

SUPPORTING EARLY CAREER ACADEMIC (SECA) PROGRAM

MAKERERE UNIVERSITY

DISSEMINATION WORKSHOP

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Fellow's Team

- **Research Fellow:** Dr. Susan Namirembe Kavuma, Senior Lecturer, Department of Policy and Development Economics, School of Economics, COBAMS.
- **Co-Investigator:** Dr. Amos Sanday, Lecturer Kyambogo University.
- **Mentor:** Associate Professor Ibrahim Mike Okumu, COBAMS - Makerere University
- **Graduate student:** Herbert Abaho pursuing a Master of Arts Degree in Economics, COBAMS- Makerere University
- **Research Assistants:** undergraduate and graduate students collected primary data

Why Focus on Road Infrastructure?

- Urbanization is closely linked with economic progress
- According to the (World Bank, 2019), cities generate about 80% of global GDP. Cities also account for a sizeable share of output, employment and population globally. Currently, about 4.2 billion people live in cities globally
- Yet, the structure of cities in developing countries particularly Africa is characterised by low connectivity, low density and inefficiency of public transport infrastructure, which makes mobility difficult due to congestion costs arising from traffic jam leading to higher commuter and transportation costs faced by firms thus hampering urban productivity (Teravaninthorn & Raballand, 2009).
- The low connectivity and urban density, coupled with unplanned spatial expansion, often robs the city of vital economic density, making the cities economically inefficient due to congestion costs.

Why select Kampala?

- Greater Kampala Metropolitan Area (GKMA) which includes Wakiso and Mukono is the main hub of economic and industrial activities, accounting for 70% of the country's manufacturing plants, producing a third of the country's manufacturing GDP. Kampala also provides 46% of all formal employment in the country. However, 50% of Kampala's residents live in slums, while 62% in informal settlements (World Bank, 2017).
- The Kampala's fragmented urban and inefficient transport and public infrastructure network has been identified as a key barrier to the growth and competitiveness of firms (World Bank, 2013). Similarly, Kampala's road network is dominated by motorcycles (boda bodas), taxis and private cars (private cars are estimated to be growing at 11% per year) (World Bank, 2017).
- Although Greater Kampala Metropolitan Area (GKMA), under the Kampala Capital City Authority (KCCA) has undertaken a series of public infrastructure projects including the Northern- and Southern-by-pass to enhance the connectivity, mobility and to decongest the city and spur growth and competitiveness, the state of roads is still poor with lack of public transport.
- In general, firm concentration in Kampala's Central Business District (CBD) has declined from 65% of firms in 2002 to 55% in 2011.
- Emerging evidence on firm productivity in developing countries suggests that there are large gaps in productivity and variability in output across firms (Bloom, et al., 2010; Syverson, 2011; Bartelsman, Haltiwanger, and Scarpetta, 2013). **Could the poor performance across firms in developing countries, be a consequence of poor transport infrastructure network?**

Firm Productivity - our Contribution

- Contributes to a growing strand of literature that examines the impact of urban transport infrastructure spill-overs on firm performance, labour productivity and the distribution of economic activity.

- Empirical literature that analyses the impact of road infrastructure on firm productivity for low income countries particularly in Africa is scanty.

Description of data

Collected primary data from 504 firms in GKMA which are mainly service firms

Table 1: Descriptive statistics

Variable	Mean	Std. Dev	Min	Max
Sales	3.62 billion	45.6 billion	2.5 million	70 billion
Labour	110 million	548 million	0.9 million	1.2 billion
Capital	37.3 billion	529 billion	0.3 million	101 billion
Materials	481 million	2.54 billion	0.1 million	20 billion
Male	72.42	0.4	1	2
Located on main road	70.83	0.45	1	2
Education - has University Degree	75.79	0.78	1	4
Access to electricity	99	0.099	1	2
Access to internet	59. 33	0.49	1	2
Days worked in a week	6.18	0.71	3	7
Years of experience	2.83	1.26	1	5
Age of firm	2.84	1.5	1	6
Domestic ownership (76-100%)	84.33	1.03	1	4

Methodology

- We estimate the impact of road infrastructure on firm productivity using a two stage estimation procedure following Sahu and Narayanan (2011).
- In the first stage we estimate OLS of translog of variables to obtain the total factor productivity (TFP) from the following equation:

$$\ln S = \propto + \beta_L lnL + \beta_K lnK + \beta_M lnM \qquad \text{(i)}$$

Where α – intercept, S- output (sales), L-labour, K- capital stock, M- intermediate materials and $\beta_L, \beta_K, \beta_M$ are parameters to be estimated.

In the second stage we find out the impact of road infrastructure and other covariants on TFP

$$\hat{Q} = \propto + \beta_1 GE + \beta_2 RD + \beta_3 EDU + \beta_4 IND + \beta_5 ELE + \beta_6 INT +$$

$$\beta_7 DAYS + \beta_8 EXP + \beta_9 AGE + \beta_{10} OWN + \varepsilon_i \qquad \text{(ii)}$$

Methodology Cont'd

- Where GE – gender of enterprise head, RD – road infrastructure (nature of road), EDU – level of education of enterprise head, IND – industry, ELE – access to electricity, INT – access to internet, DAYS- days worked in a week, EXP – experience of enterprise head, AGE- age of the firm, OWN- type of ownership of firm

- Road infrastructure was measured in several ways – whether located on the main road, nature of main road (tarmac, murrum well graded/seasonal), rating of main road, how far firm is located from the main road (km/meters)

Results

Table 1: First Stage Results

Variable	Coefficient	Robust Std. Err.	t-statistics
Labour	0.535	0.093	5.78***
Capital	0.127	0.041	3.08***
Materials	0.024	0.016	1.52
Intercept	6.934	1.417	4.89***
R^2	0.300		
Prob >F	0.000***		
Observations	477		

Results Cont'd

Table 2: variation in TFP by Firm Size

Firm size	Mean	Median	Min	Max
Micro	17.63	17.71	11.12	19.76
Small	18.42	18.43	10.31	20.70
Medium	19.43	19.31	16.27	21.84

Results Cont'd

Table 3: Second Stage Results

Variable	Coefficient	Robust Std. Err.	t-statistics
Gender	-0.126	0.131	-0.96
Education	0.197	0.076	2.57***
Industry	-0.010	0.015	-0.63
Located on main road	0.195	0.117	1.66*
Access to electricity	1.449	1.005	1.44
Access to internet	0.638	0.142	4.48***
Days worked	-0.005	0.075	-0.06
Experience	0.127	0.066	1.91*
Business age	0.150	0.058	2.57***
Domestic ownership	-0.037	0.085	-0.43
Intercept	19.597	1.013	19.34***
Prob >F	0.000***		
R^2	0.201		
Observations	477		

Conclusion

❖Labour plays the greatest role in determining TFP of firms which is consistent with literature (Sahu and Narayanan, 2011), followed by capital

❖We investigated firm specific characteristics that influence TFP and found six significant variables:

- location along the main road positively but weakly influences TFP
- Level of education positively and strongly influences TFP
- Internet usage positively and strongly influences TFP
- Experience of enterprise head positively but weakly influences TFP
- Age of business positively and strongly influences TFP
- Some factors not accounted for given the significant intercept

✓Road infrastructure affects firm performance but results show a weak link, it could be because of how the variable was measured but also the aggregate measure of infrastructure masks its effect on firm performance (Escribano et al, 2009)

✓Key policy variables to consider are labour productivity, access to internet (digitalisation), firm survival and road infrastructure.

Other activities

- Supervised graduate student

- Participated in two training courses –
  - merging, cleaning and analyzing longitudinal data
  - microsimulations and computer general models.

Output

- Two studies: i) The Effect of Road Transport Infrastructure on Firm Performance in Uganda: Evidence from Kampala, ii) The Effect of road infrastructure on firm location in Kampala
- Facilitated the development of a master's programme for development economics

Benefits/challenges

- No such study has been conducted for Uganda.
- Used an empirical method – two-step method to analyse effect of road transport on firm productivity
- Random selection of firms was challenged by the high rate of firm closure
- COVID-19 lockdowns

Lessons learnt and policy recommendations

- Observed a high mortality rate of firms which presents an empirical question
- Road infrastructure affects firm productivity but weakly which is consistent with literature but also could be due to how it is measured.
- Need to have spatial data to effectively analyse the effect of road infrastructure on firm productivity
- Human capital has the greatest impact on firm productivity

Appreciation

- Carnegie Corporation
- Directorate of Research & Graduate Training (DRGT) – Makerere University
- Department of Policy & Development Economics
- Mentor
- Partners – KCCA other LGs – Wakiso and Mukono
- Respondents

THANK YOU !


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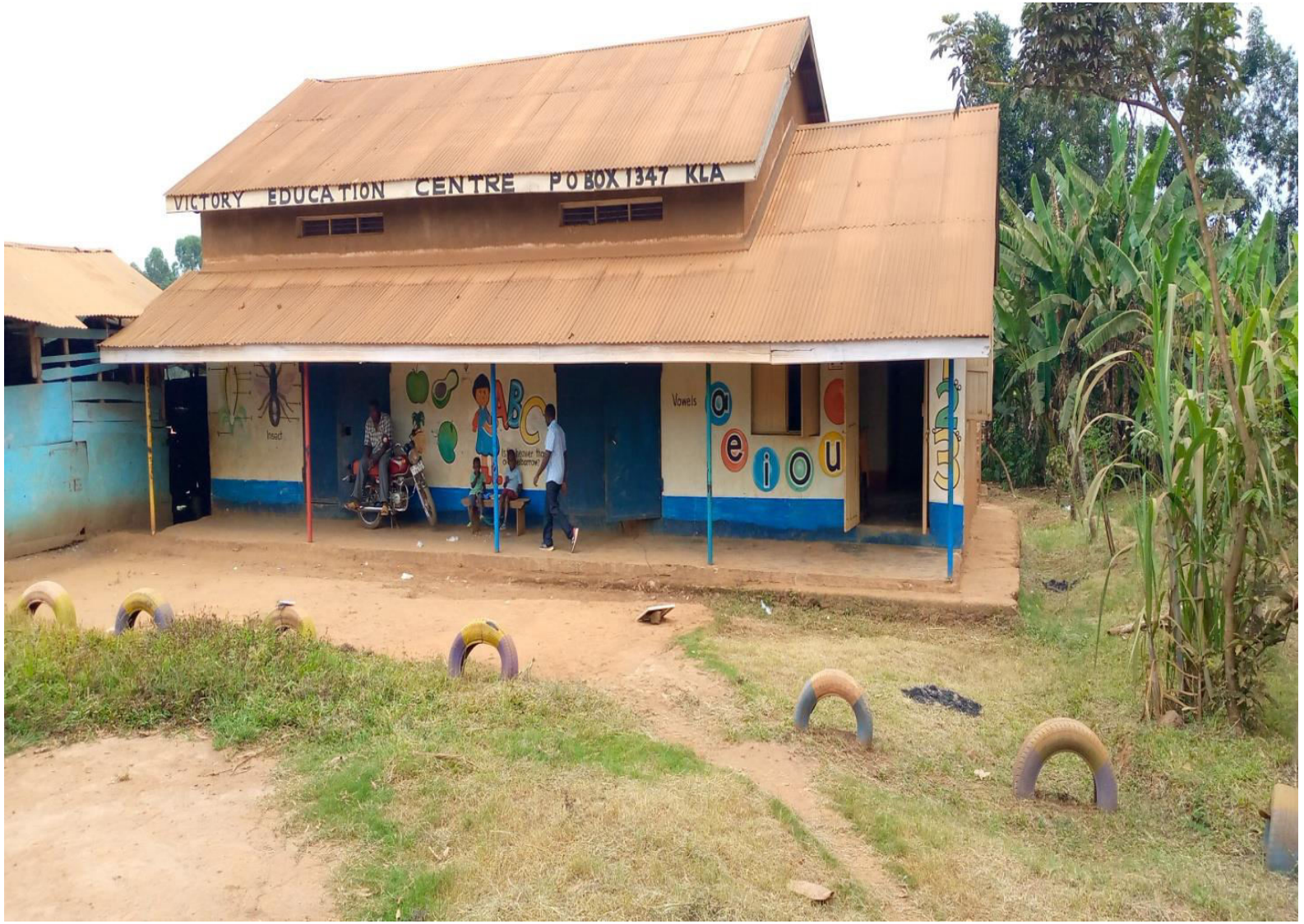

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