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Swedish University of Agricultural Sciences

Department of Economics

The impact of rural electrification and institutional quality on agricultural output - a case of Sub-Saharan Africa

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Dedication

I dedicate this thesis to my ever-supportive husband, Franklin, my family and Africa.

Abstract

Agriculture is the means of livelihood for most rural communities in Sub-Saharan Africa. In order for small-scale farmers to meet the basic needs of their families and semi-large-scale farming for trading purposes, rural farmers seek to expand their output. To this end, the kind of input employed in the crop production process is very important. In terms of labour, most rural farmers employ their children or other family members and or members of the community where they use traditional farming tools. The use of energy and for that matter, electricity is very little. What happens when rural farmers have access to electricity? What happens if their homes and farms had a constant supply of electricity? Would the farmers spend more time on the farm knowing that they could increase their output and finish household tasks later in the evening when it gets dark because they have access to electricity? The purpose of this thesis is to test the impact of rural electrification on agricultural output. More precisely, I focus on rural household access to electricity on a macro level. I also try to draw a link between a country's institutional quality and the impact of electrification. I make use of data drawn from the Food and Agriculture Organization of the United Nations, World Bank Development Indicators Aklin, S. P., & Urpelainen (2018) and the World Bank Climate Change Knowledge Portal, using date from 1990 to 2016. To do this, I employ a simple Cobb-Douglas production function approach where agricultural output is a function of labour, capital, electrification and other inputs such as rainfall, temperature and land. I later introduce a variable which measures the quality of institution for a country. The study concludes that rural electrification does have a positive effect on agricultural output; the interaction between electrification and institutions has a significant positive effect on agricultural output; and the efficiencies of labour and land also have a positive effect on agricultural output. For this reason, I suggest that governments and policymakers should focus on providing electricity to their rural communities to increase yield in agriculture.

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Abbreviations

FAO-UN: Food and Agricultural Organization of the United Nations

GDP: Gross Domestic Product

SSA: Sub-Saharan Africa

WDI: World Bank Development Indicators

In conclusion, every Sub-Saharan country is unique in every way. The differences in culture, government and agricultural focus goes a long way to determine how each country puts electricity to use. It is also noteworthy that some of the policies that will be considered in one country may not be externally valid for other countries. For example, some agricultural policies that will be working well for Ghana may not be ideal for South Africa or Botswana. Even though this study looks at Sub-Saharan Africa as a whole, the region is made up of different countries with their individual governments and hence institutional quality are also different. To this end, policies on electrification should be country-based.

References

Adom, P. K., Djahini-Afawoubo, D. M., Mustapha, S. A., Fankem, S. G., & Rifkatu, N. (2018). *Does FDI moderate the role of public R&D in accelerating agricultural production in Africa?* https://doi.org/10.1108/AJEMS-07-2017-0153

Aklin, M., S. P., H., & Urpelainen, J. (2018). *A Global Analysis of Progress in Household Electrification* (SSRN Scholarly Paper No. ID 3220460). Retrieved from Social Science Research Network website: https://papers.ssrn.com/abstract=3220460

Alene, A. D. (2010). *Productivity growth and the effects of R&D in African agriculture*. https://doi.org/10.1111/j.1574-0862.2010.00450.x

Assunção, J., Szerman, D., Lipscomb, M., & Mobarak, A. M. (2017). *Electrification, Agricultural Productivity and Deforestation in Brazil*. Retrieved from https://climatepolicyinitiative.org/publication/eletrification-agricultural-productivity-deforestation-brazil/

Barrios, S., Ouattara, B., & Strobl, E. (2008). The impact of climatic change on agricultural production: Is it different for Africa? *Food Policy*, *33*(4), 287–298. https://doi.org/10.1016/j.foodpol.2008.01.003

Bhatia, R. (1985). *Energy and agriculture in developing countries*. *13*(4), 330–334. https://doi.org/10.1016/0301-4215(85)90026-6

Binswanger, H. P., Khandker, S. R., & Rosenzweig, M. R. (1993). How infrastructure and financial institutions affect agricultural output and investment in India. *Journal of Development Economics*, *41*(2), 337–366. https://doi.org/10.1016/0304-3878(93)90062-R

Cabraal, R. A., Barnes, D. F., & Agarwal, S. G. (2005). *Productive Uses of Energy for Rural development*. 117–144. https://doi.org/10.1146/annurev.energy.30.050504.144228

Chen, W., & Ding, Y. (2007). Total Factor Productivity in Chinese agriculture: The role of infrastructure. *Frontiers of Economics in China*, *2*(2), 212–223. https://doi.org/10.1007/s11459-007-0011-3

Das, K. (2008). *Electricity and Rural Development Linkage*. Retrieved from https://ideas.repec.org/p/ess/wpaper/id1749.html

Fan, S., JITSUCHON, S., & METHAKUNNAVUT, N. (2004). The importance of public investment for reducing rural poverty in middle-income countries | IFPRI. Retrieved February 22, 2019, from http://www.ifpri.org/publication/importance-public-investment-reducing-rural-poverty-middle-income-countries

Fan, S., Zhang, L., & Zhang, X. (2002). *Growth, Inequality, and Poverty in Rural China: The Role of Public Investments*. https://doi.org/10.2499/0896291286rr125

Fan, S., Zhang, L., & Zhang, X. (2004). Reforms, Investment, and Poverty in Rural China. *Economic Development and Cultural Change*, *52*(2), 395–421. https://doi.org/10.1086/380593

Fan, S., & Zhang, X. (2004). Infrastructure and regional economic development in rural China. *China Economic Review*, *15*(2), 203–214. https://doi.org/10.1016/j.chieco.2004.03.001

FAO. (1996). *The state of food and agriculture*. Retrieved from http://www.fao.org/3/w1358e/w1358e.pdf

Fulginiti, L. E., Perrin, R. K., & Yu, B. (2004). *Institutions and agricultural productivity in Sub-Saharan Africa*. 169–180. https://doi.org/10.1016/j.agecon.2004.09.005

Galanopoulos, K., Surry, Y., & Mattas, K. (2011). Agricultural Productivity Growth in the Euro-Med Region: Is There Evidence of Convergence? *Outlook on Agriculture*, *40*(1), 29–37. https://doi.org/10.5367/oa.2011.0026

Haanyika, C. M. ga. (2006). *Rural electrification policy and institutional linkages*. *34*(17), 2977–2993. https://doi.org/10.1016/j.enpol.2005.05.008

Hall, R. E., & Jones, C. I. (1997). Levels of Economic Activity Across Countries. *The American Economic Review*, *87*(2), 173–177.

Hayami, Y., & Ruttan, V. W. (1970). Agricultural Productivity Differences among Countries. *The American Economic Review*, *60*(5), 895–911.

Hazell, P., & Herdt, R. (1987). Agricultural development: An international perspective. *Journal of Development Economics*, *26*(1), 197–200. https://doi.org/10.1016/0304-3878(87)90069-1

J. Coelli, T., & Rao, D. S. (2003). *Total Factor Productivity Growth in Agriculture: A Malmquist Index Analysis of 93 Countries,1980-2000*.

Kahsay, G. A., & Hansen, L. G. (2016). The effect of climate change and adaptation policy on agricultural production in Eastern Africa. *Ecological Economics*, *121*, 54–64. https://doi.org/10.1016/j.ecolecon.2015.11.016

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2005). *Governance matters IV: governance indicators for 1996–2004*. Retrieved from World Bank. website: http://documents.worldbank.org/curated/en/602061468313750126/Governance-matters-IV-governance-indicators-for-1996-2004

Khandker, S. R., & Koolwal, G. B. (2010). How infrastructure and financial institutions affect rural income and poverty: evidence from Bangladesh. *The Journal of Development Studies*, *46*(6), 1109–1137. https://doi.org/10.1080/00220380903108330

Knox, J., Daccache, A., & Hess, T. (2013). What is the impact of infrastructural investments in roads, electricity and irrigation on agricultural productivity? Final Review. Retrieved February 21, 2019, from GOV.UK website: https://www.gov.uk/dfid-

research-outputs/what-is-the-impact-of-infrastructural-investments-in-roads-electricity-and-irrigation-on-agricultural-productivity-final-review

Limi, A., & Smith, J. W. (2007). *What is Missing Between Agricultural Growth and Infrastructure Development? Cases of Coffee and Dairy in Africa*. World Bank Publications.

Lio, M., & Liu, M.-C. (2008). Governance and agricultural productivity: A cross-national analysis. *Food Policy*, *33*(6), 504–512. https://doi.org/10.1016/j.foodpol.2008.06.003

Méon, P.-G., & Weill, L. (2005). Does better governance foster efficiency? An aggregate frontier analysis. *Economics of Governance*, *6*(1), 75–90. https://doi.org/10.1007/s10101-004-0080-z

Mundlak, Y. (2002). *Determinants of agricultural growth in Indonesia, the Philippines, and Thailand* (No. WPS2803; p. 1). Retrieved from The World Bank website: http://documents.worldbank.org/curated/en/532201468759864513/Determinants-of-agricultural-growth-in-Indonesia-the-Philippines-and-Thailand

Namara, R. E., Hanjra, M. A., Castillo, G. E., Ravnborg, H. M., Smith, L., & Van Koppen, B. (2010). Agricultural water management and poverty linkages. *Agricultural Water Management*, *97*(4), 520–527. https://doi.org/10.1016/j.agwat.2009.05.007

Nkurunziza, J., & Bates, R. (2004). *Political institutions and economic growth in Africa*.

OECD-FAO. (2018). *Crop Production* [Agricultural Outlook]. Retrieved from OECD-FAO website: https://data.oecd.org/agroutput/crop-production.htm

Patel, A. (2010). *Infrastructure For Agriculture & Rural Development In India*. 17.

Phillips, P. C. B. (1995). Fully Modified Least Squares and Vector Autoregression. *Econometrica*, *63*(5), 1023. https://doi.org/10.2307/2171721

Phillips, P. C. B., & Hansen, B. E. (1990). Statistical Inference in Instrumental Variables Regression with I(1) Processes. *The Review of Economic Studies*, *57*(1), 99–125. https://doi.org/10.2307/2297545

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Last but not least, I thank God Almighty and the church for their support in prayers and words of encouragement.

Appendix

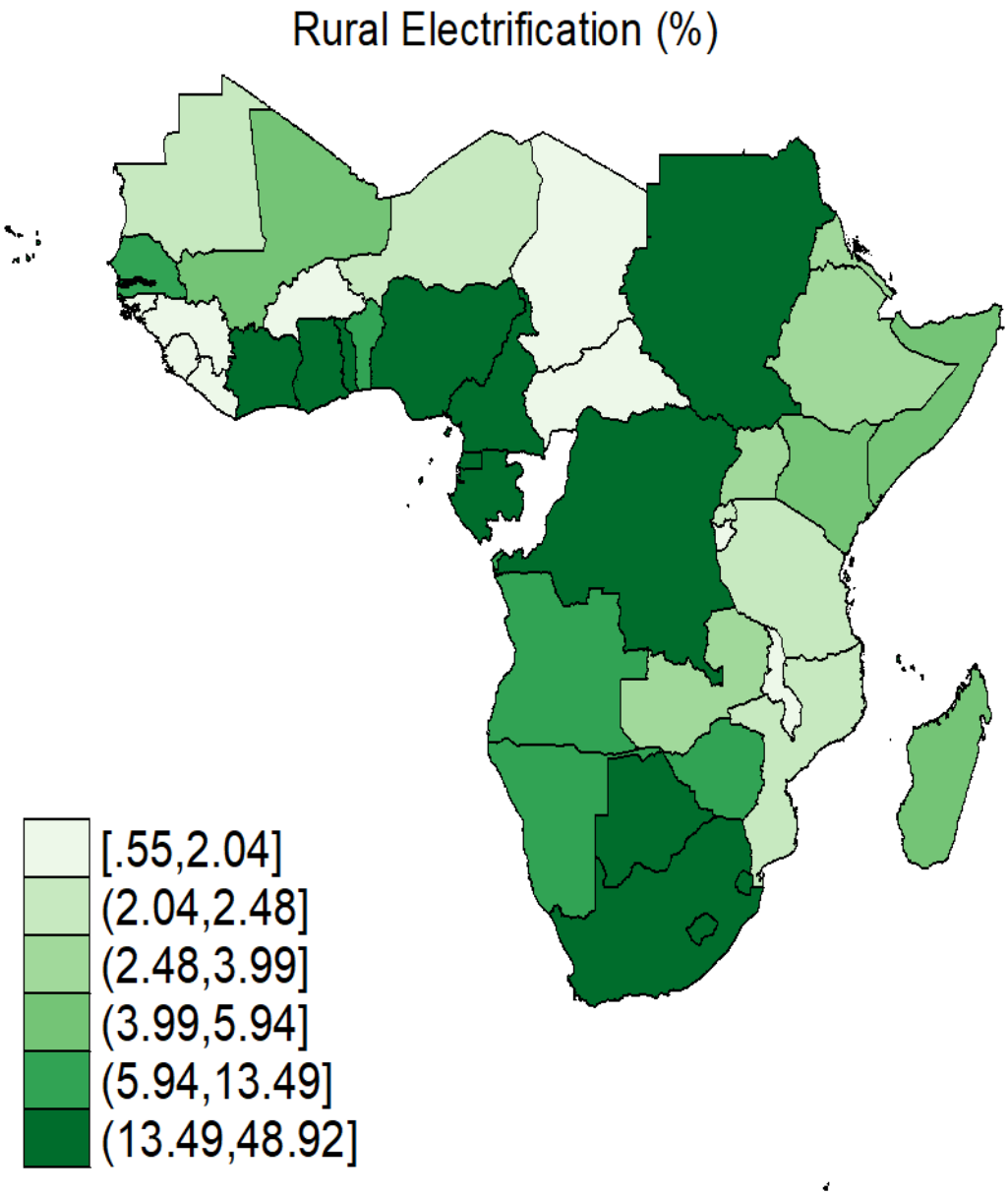


Figure 8:Percentage of rural electrification in Sub-Saharan Africa.

Source: own computation from (Aklin et al., 2018)

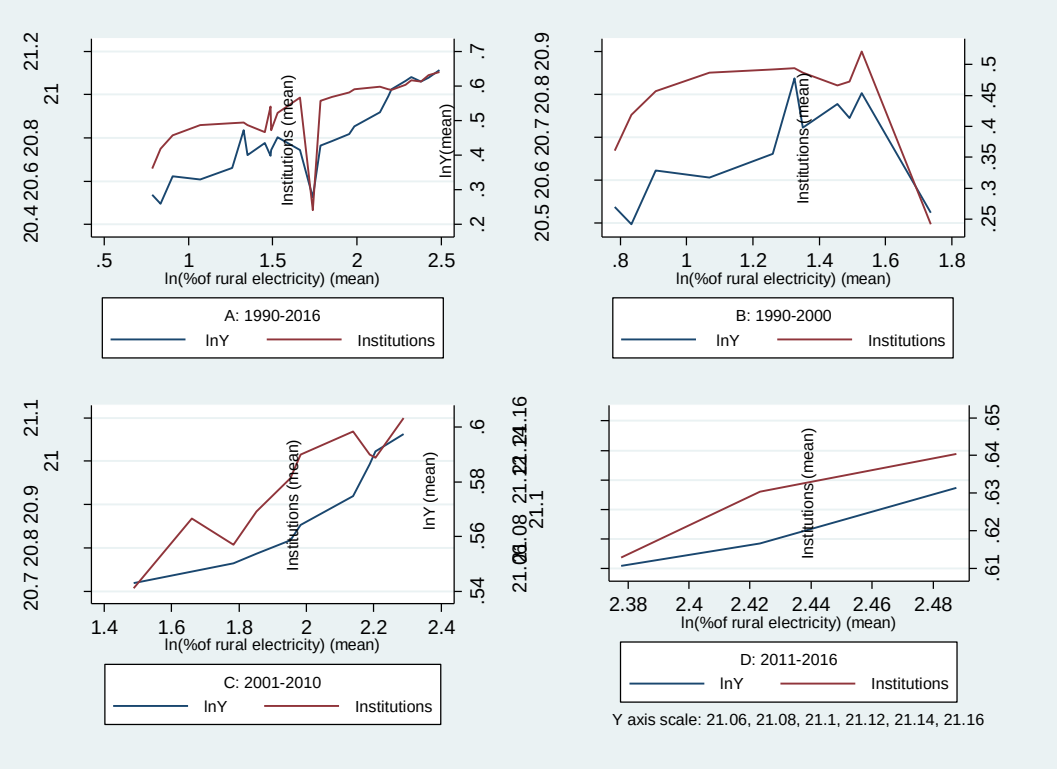


Figure 9: Trend of output and electrification from 1990-2016

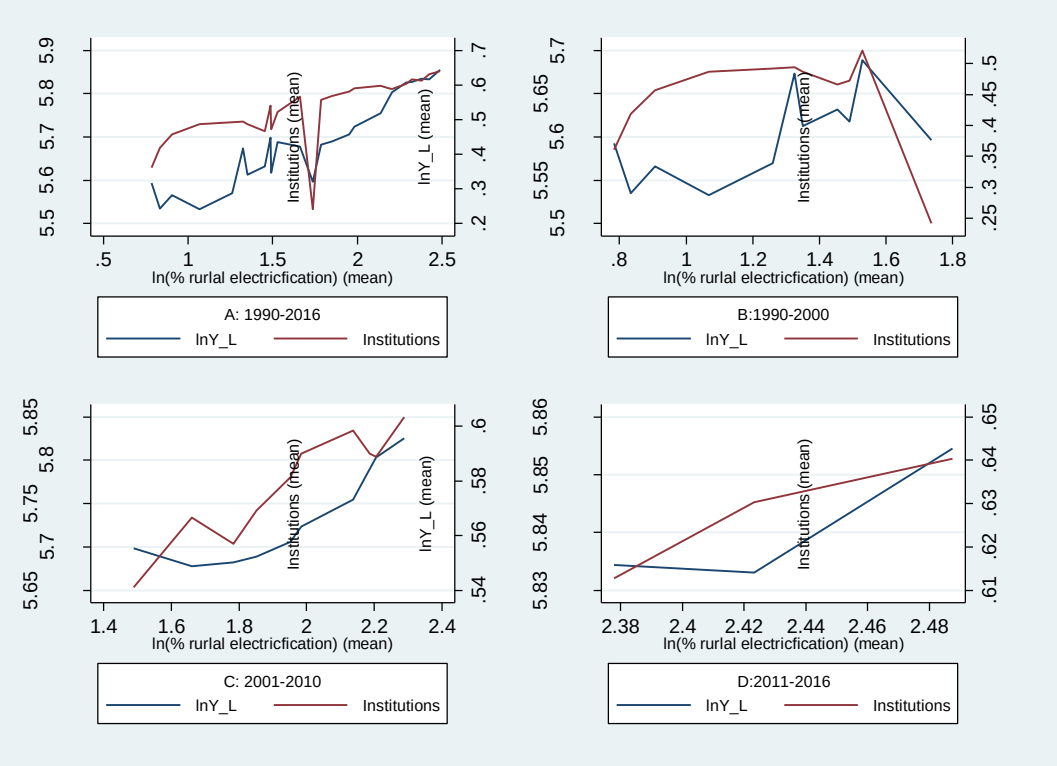


Figure 10: Trend of electrification and output per land from 1990-2016

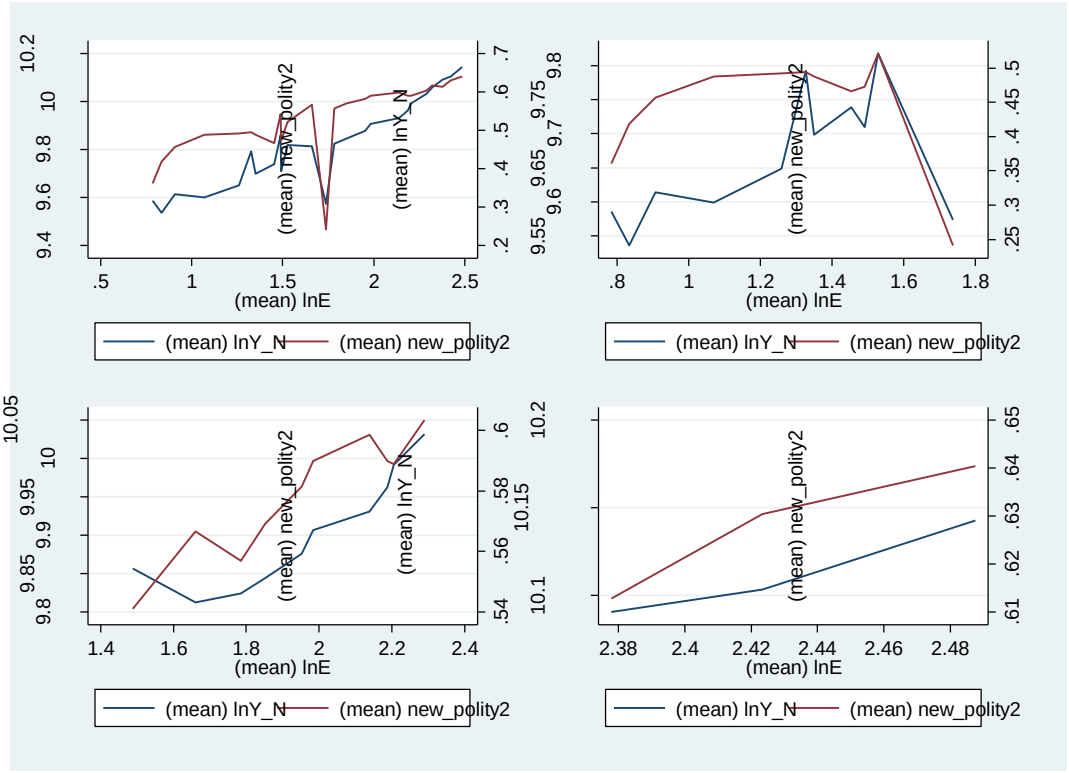
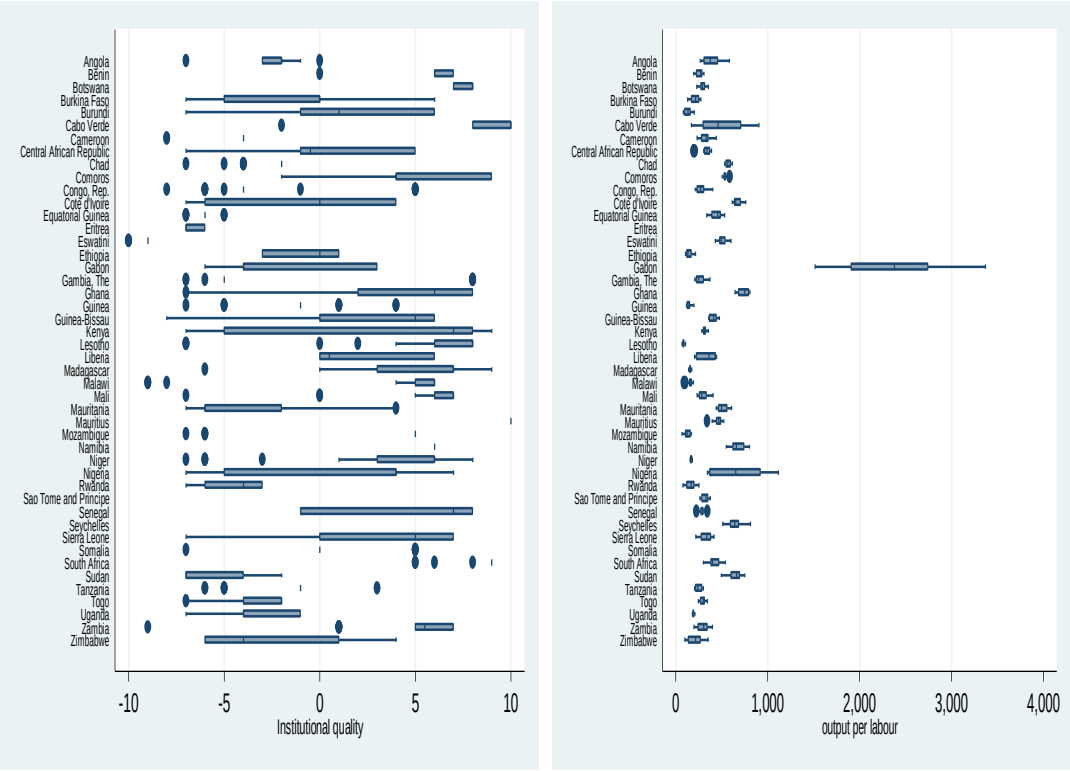
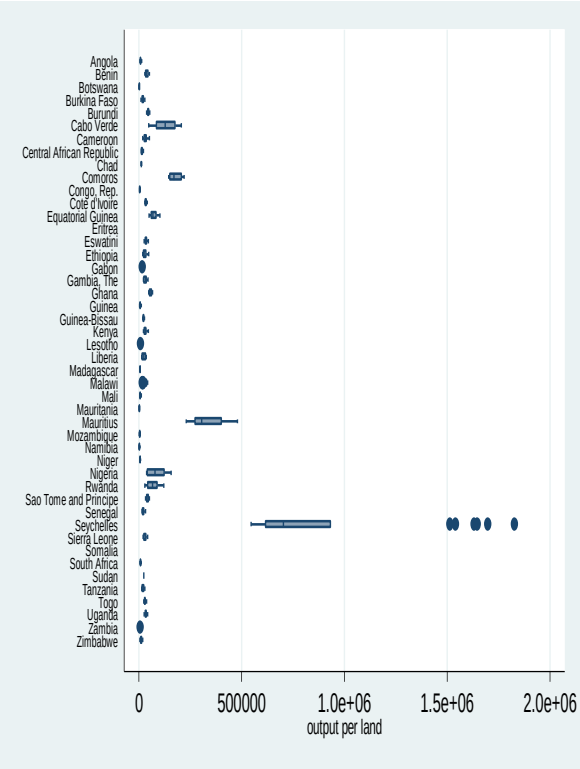


Figure 11: Trend of electrification and output per land from 1990-2016

Figure 12: Box plots for the various variables

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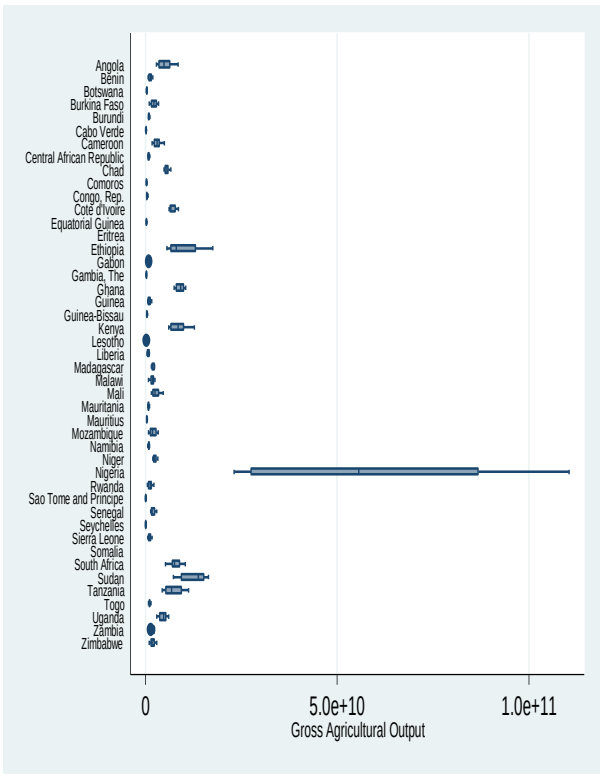
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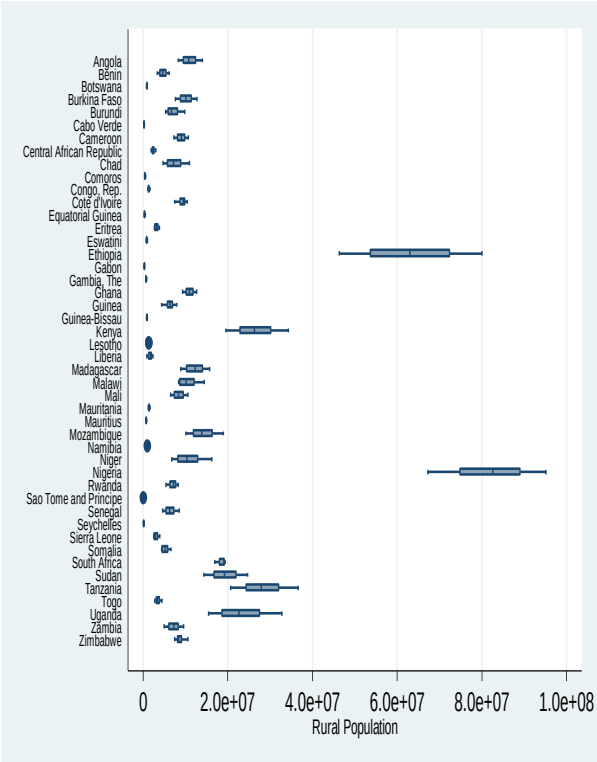
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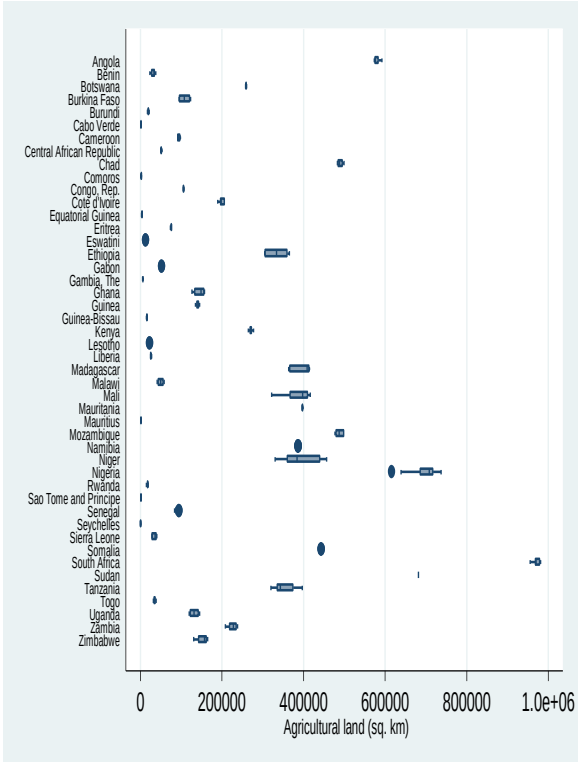
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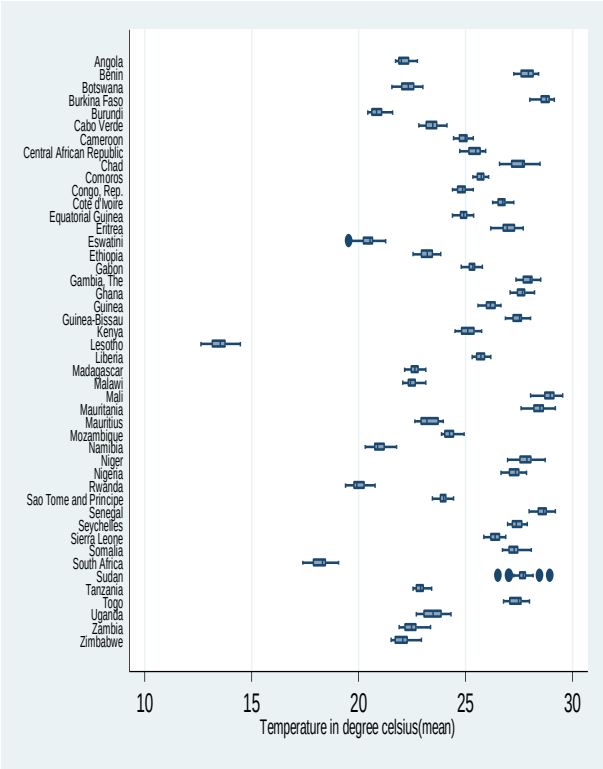
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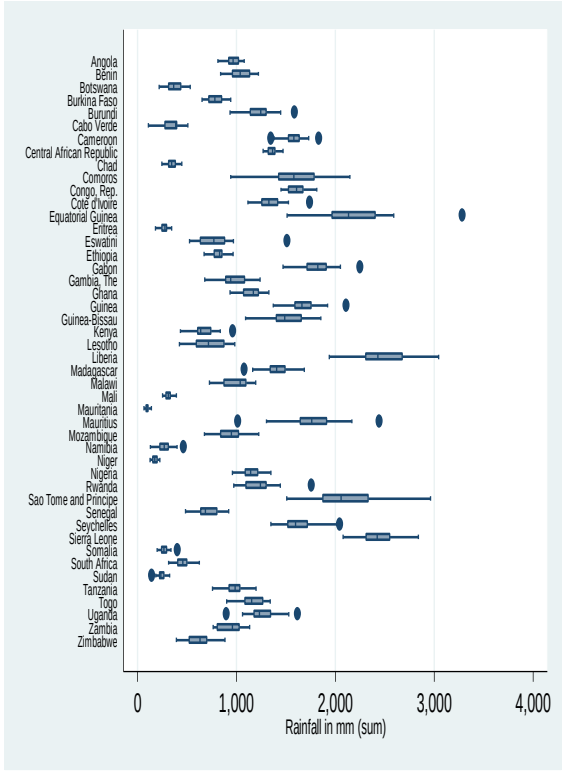
Temperature in degree celsius(mean)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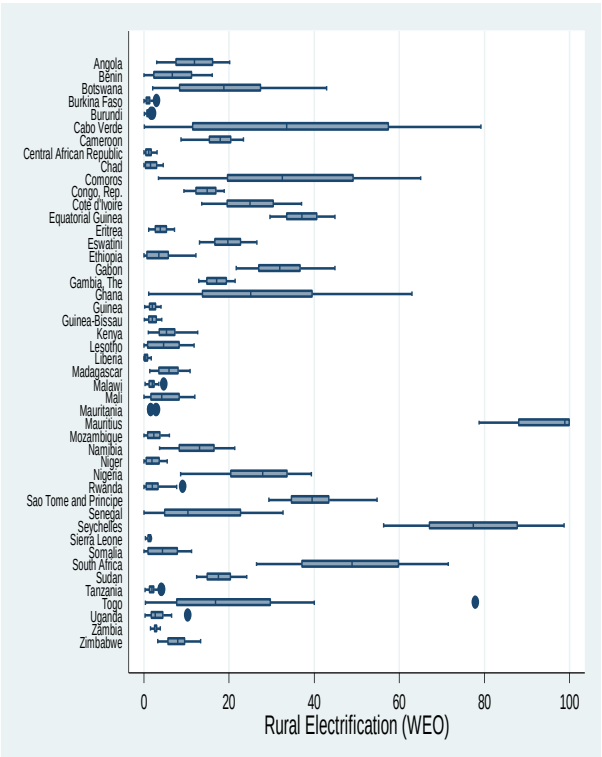
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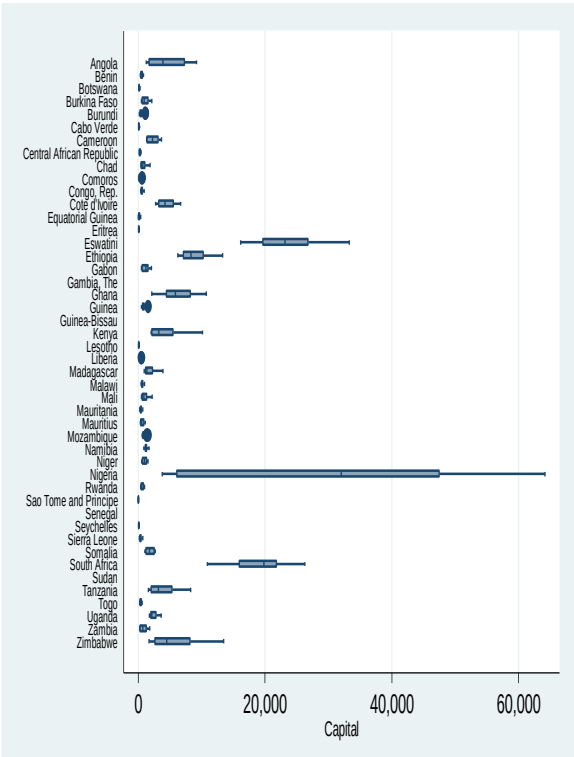
Rural Electrification (WEO)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Capital

Table 8: Correlation Matrix

	lnL	lnN	lnT	lnR	lnE_1	Ins_1	lnK
lnL	1						
lnN	0.7973***	1					
lnT	-0.0206	-0.0207	1				
lnR	-0.1901***	-0.4270***	-0.0518*	1			
lnE_1	-0.3192***	-0.3139***	-0.0085	0.1315***	1		
Ins_1	-0.0948***	-0.0886***	-0.2080***	-0.0288	0.1594***	1	
lnK	0.7767***	0.6722***	0.0565*	-0.0913***	0.0346	0.0289	1

*** p<0.01, ** p<0.05, * p<0.1

Table 9: FMOLS efficiency without L and N in main model

VARIABLES	(1) lnY_L	(2) lnY_L	(3) lnY_N	(4) lnY_N
lnE_1	0.036***	0.031***	0.042***	0.035***
	(0.002)	(0.002)	(0.002)	(0.003)
Ins_1	-0.044***	-0.105***	-0.017**	-0.092***
	(0.013)	(0.009)	(0.008)	(0.014)
lnT	0.765***	1.116***	0.482***	0.706***
	(0.172)	(0.099)	(0.112)	(0.154)
lnR	0.105***	0.079***	0.071***	0.064***
	(0.013)	(0.007)	(0.008)	(0.012)
lnN	0.311***	0.223***		
	(0.037)	(0.024)		
lnK		0.085***		0.078***
		(0.004)		(0.006)
lnL			-0.062***	-0.008
			(0.019)	(0.028)
Constant	-1.364*	-1.763***	7.832***	5.694***
	(0.780)	(0.479)	(0.497)	(0.727)
Observations	848	691	848	691
R-squared	0.714	0.796	0.914	0.941
Country FE	YES	YES	YES	YES
Trend	YES	YES	YES	YES
Adjusted R-squared	0.697	0.782	0.909	0.937
Long Run SE	0.0530	0.0267	0.0343	0.0415
Bandwidth(neweywest)	269.5	803.8	645.7	281.7

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Fixed Effect model for electrification and institution interaction

VARIABLES	(1) lnY	(2) lnY	(3) lnY_L	(4) lnY_L	(5) lnY_N	(6) lnY_N
lnE_1	0.038	0.026	0.038	0.026	0.038	0.026
	(0.040)	(0.051)	(0.040)	(0.051)	(0.040)	(0.051)
Ins_1	-0.020	-0.108	-0.020	-0.108	-0.020	-0.108
	(0.116)	(0.182)	(0.116)	(0.182)	(0.116)	(0.182)
Elec_Ins	0.009	0.017	0.009	0.017	0.009	0.017
	(0.052)	(0.068)	(0.052)	(0.068)	(0.052)	(0.068)
lnL	0.031	0.111	-0.969***	-0.889**	0.031	0.111
	(0.322)	(0.353)	(0.322)	(0.353)	(0.322)	(0.353)
lnN	0.699*	0.686*	0.699*	0.686*	-0.301	-0.314
	(0.379)	(0.367)	(0.379)	(0.367)	(0.379)	(0.367)
lnK		0.076		0.076		0.076
		(0.062)		(0.062)		(0.062)
lnT	0.345	0.591	0.345	0.591	0.345	0.591
	(0.688)	(0.808)	(0.688)	(0.808)	(0.688)	(0.808)
lnR	0.066	0.059	0.066	0.059	0.066	0.059
	(0.053)	(0.059)	(0.053)	(0.059)	(0.053)	(0.059)
Timetrend	0.021***	0.017**	0.021***	0.017**	0.021***	0.017**
	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)
Constant	10.761***	8.559**	10.761***	8.559**	10.761***	8.559**
	(3.639)	(4.139)	(3.639)	(4.139)	(3.639)	(4.139)
Observations	849	692	849	692	849	692
R-squared	0.589	0.539	0.295	0.251	0.495	0.446
No. countries	41	37	41	37	41	37
Country FE	YES	YES	YES	YES	YES	YES
Trend	YES	YES	YES	YES	YES	YES
Adjusted R-squared	0.585	0.533	0.288	0.241	0.490	0.438
Fstat_p	0	0	8.69e-05	0.000181	2.04e-10	2.22e-08

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: FMOLS efficiency without L and N in main model (interaction)

VARIABLES	(1) lnY_L	(2) lnY_L	(3) lnY_N	(4) lnY_N
lnE_1	0.001	-0.012***	0.037***	0.024***
	(0.001)	(0.005)	(0.002)	(0.006)
Ins_1	-0.110***	-0.208***	-0.025***	-0.119***
	(0.004)	(0.017)	(0.006)	(0.020)
Elec_Ins	0.059***	0.072***	0.007***	0.019**
	(0.002)	(0.007)	(0.002)	(0.008)
lnT	0.900***	1.081***	0.502***	0.717***
	(0.051)	(0.155)	(0.071)	(0.176)
lnR	0.107***	0.084***	0.071***	0.067***
	(0.004)	(0.012)	(0.005)	(0.013)
lnN	0.337***	0.299***		
	(0.011)	(0.038)		
lnK		0.073***		0.075***
		(0.006)		(0.007)
lnL			-0.050***	0.018
			(0.012)	(0.034)
Constant	-2.085***	-2.519***	7.577***	5.261***
	(0.233)	(0.755)	(0.323)	(0.848)
Total effect of Elec_1	0.031***	0.0258***	0.041***	0.0336***
	(0.001)	(0.003)	(0.001)	(0.003)
Observations	848	691	848	691
R-squared	0.717	0.804	0.909	0.946
Country FE	YES	YES	YES	YES
Trend	YES	YES	YES	YES
Adjusted R-squared	0.701	0.791	0.903	0.942
Long Run SE	0.0157	0.0419	0.0216	0.0475
Bandwidth(neweywest)	3269	280	1709	239.5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1