Discussion Paper Series

RIEB

Kobe University

DP2010-26

Economic Effects of Clustering of Ethnically Similar Communities in Kenya: Application of Spatial Correlation Model*

Nobuaki HAMAGUCHI

October 1, 2010

Research Institute for Economics and Business Administration

Kobe University

2-1 Rokkodai, Nada, Kobe 657-8501 JAPAN

Economic Effects of Clustering of Ethnically Similar Communities in Kenya: Application of Spatial Correlation Model

Nobuaki Hamaguchi
Research Institute for Economics and Business Administration
Kobe University
(hamaguchi@rieb.kobe-u.ac.jp)

Abstract

Using regional data of Kenya, we found that income spillovers depend on ethnic similarity, which suggests the influence of ethnic bias. This result implies, for policy making, that the question of interregional transaction costs cannot be narrowly focused on problems of transportation infrastructure but it is also related with ethnic divisions in African context.

Keyword: Ethnic diversity, transaction cost

JEL classification: R58, O18

Acknowledgement: This paper is a contribution to the research project on *Ethnic diversity and Economic Instability in Africa: Policies for Harmonious Development*, jointly organized by RIEB-Kobe University and JICA Research Institute. I acknowledge the support from the both institutions. The author has benefited from valuable comments from the participants in the project workshop on *Cases of Economic Instability in Africa* (Yale University, January 16-17, 2010). This study is supported by Grant-In-Aid for Scientific Research #22330085 by Japan Society for the Promotion of Science.

1. Introduction

Africa's economic development has been affected by unfavorable economic geography (Venables, 2010). On the continent where most people depend upon agriculture, endowments of high-quality agricultural land with adequate rainfall are scarce. There is a high propensity to disease, both in humans and animals. Location is also an important matter. Aside from being a long distance from the world's main economic hubs, many countries are land-locked. Sub-Saharan Africa as a whole has virtually no navigable river and few natural harbors.

Collier and Venables (2010) and Venables (2010) point out that Africa's economic growth prospects are also affected by its fragmentation into more than 50 small nations. Because economies of scale are forgone, the costs of public good provision are high and supplies of private goods are often monopolized. Moreover, these impediments to private and public economies are mutually reinforcing. Based on an empirical assessment of the degree of international market integration of Sub-Saharan African countries, Bosker and Garretsen (2008) predicts that improving intraregional market access will have a considerable positive effect on economic growth.

Market integration within each country remains low, which presents three important implications for efficiency and growth of economies. First, as with the context of international economics, gains from trade based on the comparative advantages of each region will be lost. Second, factor endowments are distributed unevenly among regions. Lack of factor mobility will give rise to growth constraints in those nations with no resources, simultaneously diminishing returns to resource earnings in those who have plenty (Venables, 2000). Third, and related to the above points, an economy with high interregional trade costs and low factor mobility is prone to geographical dispersion of population and production (Fujita et al., 1999). Consequently, cities and individual production units are smaller than optimal size. Insufficient agglomeration is related with the low level of the division of labor, knowledge spillover, and higher costs of shared inputs (intermediate goods and services and local infrastructure), leading to low productivity.

Given that geographical factors strongly influence economic development in Africa, strong emphases have been given to the need for improving physical transportation infrastructure. Admitting that importance, we should also consider the presence of ethnic bias that constitutes divisions in the market economy, as often pointed out by researchers of the African economy. For example, Bates (2000) observes that because public institutions are weak in Africa, people seek a better life through private relations, such as capitalization through remittances from migrants to the cities and formation of skills through face-to-face contacts. If families organize the relations across generations and locations, then ethnicity provides rules and enforcement in such informal contracts about what should be done and what should not. Fafchamps (2004) explains that ethnic bias persists in a self-sustaining way because of *statistical discrimination* and *network effect*. The former dictates

that individuals belonging to different groups might be treated differently even if they share identical observable characteristics in every other respect because of high cost of gathering and evaluating information[1]. The latter refers to the characteristic of market transactions in Africa, which involve many intermediaries in sequential steps that are linked by the chain of trust-based personal acquaintances to minimize the potential for breach. Ethnic diversity *per se* is not a source of inefficiency because heterogeneity (in technology, taste, etc.) forms the basis for trade, as predicted by international trade theory. When ethnic diversity and ethnic bias are combined, inefficiency arises because the market is fragmented into small homogeneous markets.

It is also noteworthy that, specifically in the context of Kenya, ethnic groups have a "blocker" geographic distribution by which ethnic identities correspond reasonably well with geographic placement (Shipton, 2009). Oucho (2002) points out: "the present day provinces are largely a repeat of those created in 1924, apparently a deliberate attempt by the departing colonial administration to institutionalize tribalism or ethnocentrism in independent Kenya." (p.42) and "Kenya's districts had been so sub-divided that their structure portends intensified ethnocentrism and bright prospects for regionalism." (p.43) The separation along ethnic lines for historical reasons has been sustained through low labor mobility because of weak agglomeration economies, as described above[2]. As a result, ethnic heterogeneity at a national level co-exists with high degree of homogeneity at the local-level (Ranis, 2009). Therefore, we might observe high transaction costs in inter-regional domestic trade both in terms of physical infrastructure and ethnic divisions.

Following that discussion, this paper presents a case study of Kenya from a viewpoint that ethnic diversity, interacting with ethnic bias and geographical fragmentation, affects economic performance through low market integration. These analyses specifically examine two issues. The first is whether the economic situation of a local unit is affected by that of surrounding ones. The basic assumption here is that the lower the interjurisdictional barriers are, the more frequently people and businesses interact, thereby achieving higher welfare. The second is to investigate whether the interregional divisions are affected by ethnic heterogeneity.

The second section presents the basic structure of our empirical analysis. We will extend it to a spatial correlation model in the third section and to what we call ethnically augmented spatial correlation model in the fourth section. The final section concludes and presents discussion of future directions of study.

2. Basic model

[1] Mohamed and Zenou (2005) presented a theoretical model suggesting that discrimination in the labor market might occur along ethnic lines in developing countries where people are ethnically diverse and production is highly volatile. Employers tend to hire workers of similar ethnic background; employees from different ethnic groups bear the risk of production volatility whereas those from similar ethnic background of the employee earn a stable income.

[2] Miguel and Gugerty (2005) suggest that relocation cost is high in rural Kenya because of thin local land markets and difficulty in obtaining approval from relatives to sell the clan land.

We first set up a model without ethno-geographical elements. The estimated regression equation is shown below.

$$Y_i = \alpha_0 + \alpha_1 X_i + \alpha_2 D_i + e_i \qquad (1)$$

We investigate the poverty headcount ratio and log of per capita income as dependent variables. Included in the dependent variable set *X* are: access to main trunk roads (as a measure of infrastructure); population share having no formal basic education, or the adult illiteracy ratio (human capital); and ethnic fractionalization, or ethnic polarization (ethnic diversity). As common sense might reveal, we expect that access to roads can reduce poverty (therefore, a positive sign is assumed for the estimated coefficient) and that it has a positive impact on income; the human capital variable is expected to have a negative coefficient on poverty and positive on income. We set no preconceived notion related to the impact of ethnic diversity on poverty and income[3]. We also introduce regional dummy *D* referring to Nyanza, Rift Valley, and Nairobi & Central to capture the level differences. More detailed descriptions of variables are given in the appendix. The error term is assumed to be i.i.d. Table 1 presents some summary statistics.

Table 1

Estimated results obtained using equation (1) are presented in Table 2. We set the poverty headcount ratio as a dependent variable in the first two columns. As expected, access to trunk roads will decrease poverty; a lack of formal basic education is associated with higher incidence of poverty. Higher ethnic diversity shown by the fractionalization index has negative effect. After controlling for physical and human capital, higher fractionalization is related with a lower incidence of poverty at the district level, which suggests the role of migration from districts with a higher intensity of poverty to lower ones where ethnic diversity tends to be higher because of demographic inflow. The polarization index has no statistically significant effect. Regional dummies show that poverty is more severe in Nyanza province and less in Central and Rift Valley provinces.

Table 2

In the right-most two columns of Table 2, we chose per-capita GDP as the dependent variable.

[3] Previous studies suggest that ethnic diversity is related with higher incidence of poverty and lower income level (Easterly and Levin, 1997). Alesina and Ferrara (2004) consider the optimal level of ethnic diversity as the balance of benefit from diversity and cost of heterogeneity. They found that the former increases with the level of per capital output implying that, although ethnic diversity might not be beneficial in poor economies, it might be so in rich ones.

In this case, the effect of access to trunk roads is not statistically significant, although that of lacking basic formal education is negative, as expected. Ethnic fractionalization correlates positively with income, probably in the same context as the poverty case. Ethnic polarization has no explanatory power in this case, either. The regional dummy is only significant for Central & Nairobi.

3. Spillover from adjacent districts

Next, we include situations in adjacent districts as determinants of poverty and income. The regression we estimate is of the following form.

$$Y_i = \alpha_0 + \alpha_1 X_i + \rho W_i Y_i + e_i \qquad (2)$$

In that equation, W_i is the adjacency weight consisting of w_{ij}/n_i where we assign $w_{ij} = 1$ if districts i and j share the border and 0 otherwise; n_i denotes the number of districts that share a border with district i.[4] Equation (2) is called the *spatial correlation model* or *spatial lag model*. Table 3 reports estimated results. The coefficient ρ represents the spatial spillover effect.

Table 3

Estimated results of variables road, *no_edu adult*, *illiteracy*, *fractionalization*, and *polarization* barely change from those shown by equation (1). Focusing on estimates of parameter ρ of equation (2), we found a positive spatial correlation for the district-level poverty headcount ratio (i.e. poverty spillover), although the spatial correlation of per capita district GDP was not statistically significant: after controlling for conditions of physical and human capital and the degree of ethnic diversity, a district exhibits higher intensity of poverty if it is adjacent to poor neighbor districts, but such systematic relation is not observed for the income level.

4. Impacts of ethnicity

Now we introduce ethnicity by modifying the spatial correlation model of equation (2) to the following form:

$$Y_i = \alpha_0 + \alpha_1 X_i + \theta E_i W_i Y_i + e_i. \qquad (3)$$

[4] We do not include regional dummies that appear in equation (1) because correlation can be expected with the spatial lag term $W_i Y_i$.

where E_i stands for ethnic weights consisting of e_{ij}/e_i where e_{ij} represents population size in district *j* belonging to the ethnic group of the largest share in district *i,* and e_i is the total population of district *i*'s largest ethnic group in its all adjacent districts. Therefore, $E_i W_i Y_i$ might be designated as the *ethnicity-augmented* spatial lag term. We expect θ to be positive if poverty or income spillovers occur in *ethnically similar* adjacent districts.

Table 4

Table 4 presents the estimated results. Basic characteristics remain almost unchanged, except that the effect of ethnic fractionalization on poverty turns to be statistically not significant. More importantly, we found statistically significant positive coefficients of the ethnicity-augmented spatial lag term for both poverty and income. The case of income spillover is of particular interest. Although we did not find a spatial correlation in equation (2), Table 4 shows that the income spillover is statistically significant between ethnically similar adjacent districts. We can extend the following conjecture from this result. Interactions through the market transaction and extra-market interaction (such as knowledge exchange and technological spillovers) will be mutual beneficial of all participants. In the case of the Kenyan regional economy, income spillovers were found only between ethnically similar adjacent districts. In general, such effects are not statistically significant. Therefore, we cannot blame only the geographical division for the lack of income spillover but this suggests the case of ethnic bias, which impedes interactions across geographical space.

We found poverty spillover for both a general setting (Table 3) and an ethnically similar situation (Table 4), which suggests that ethnic filtering is not relevant in the context of poverty spillovers because factors related to the natural geography that is common to adjacent districts are dominant determinants: disease contagion, climate (temperature, rainfall/ precipitation), and soil quality.

5. Summary and conclusions

As described in this paper, we examine the influence of ethnic diversity on costs of interaction among regions. They eventually engender inefficiency of market economies. Using regional data of Kenya, we found that income spillovers depend on ethnic similarity, which suggests the influence of ethnic bias. This result implies, for policy making, that the question of interregional transaction costs cannot be narrowly focused on problems of transportation infrastructure but it is also related with ethnic divisions in African context. If confinement of interactions on ethnic lines is strong, then it will not be sufficient to construct a physical infrastructure to promote internal market integration but policies for remedying ethnic bias should be also addressed. If we were to take ethnic bias as a given

structure, then policies that allow cross-border interactions among similar ethnic groups located in different countries will create more scale economies and growth-enhancement (Shipton, 2009).

For more precise policy discussion, it is indispensable to study the *microfoundation* of ethnic bias in rigorous empirical methodology. One promising direction is the formation of trust-based divisions, as have already been studied by Fafchamps (2004). One can also examine institutional frameworks to promote trust among heterogeneous agents. We must also pursue solutions along political dimensions. Stewart (2010) states that group boundaries can be made, or even invented, by political and social leaders to achieve political or economic goals. People can be mobilized as a group for grievances and under some other banner. It is a consensual belief that ethnic diversity itself is not a source of divisions and conflicts. As Ong'wen (2010) emphasizes, inequitable distribution of land and political power in favor of particular ethnic groups and strong grievances of the people who feel exclusion are the root cause of the sporadic incidents of violent conflict.

References

Alesina, Alberto and Eliana La Ferrara (2005) "Ethnic diversity and economic performance," *Journal of Economic Literature* 43: 762-800.

Bates, Robert H. (2000) "Ethnicity and development in Africa: a reappraisal," *American Economic Review* 90: 131-134.

Bosker, Maarten and Harry Garretsen (2008) Economic geography and economic development in Sub-Saharan Africa, CESifo Working Paper 2490.

Collier, Paul and Anthony Venables (2010) "Trade and economic performance: Does Africa's fragmentation matter?" in Justin Yifu Lin and Boris Pleskovic eds. *Annual World Bank Conference on Development Economics 2009 Global*, Washington, D.C. World Bank*:* 51-76.

Easterly, William and Ross Levine (1997) "Africa's growth tragedy: policies and ethnic divisions," *Quarterly Journal of Economics* 112: 1203-50.

Fafchamps, Marcel (2004) *Market Institutions in Sub-Saharan Africa*, Cambridge, MA, MIT Press.

Fujita, Masahisa, Paul Krugman and Anthony Venables (1999) *The Spatial Economy*, Cambridge, MA, MIT Press.

Jellal, Mohamed and Yves Zenou (2005) Ethnic diversity, market structure and risk sharing in developing countries, CEPR Discussion Papers 5366.

Miguel, Edward and Mary Kay Gugerty (2005) "Ethnic diversity, social sanctions, and public goods in Kenya," *Journal of Public Economics* 89: 2325-2368.

Minnesota Population Center (2010) *Integrated Public Use Microdata Series, International: Version 6.0* [Machine-readable database]. Minneapolis: University of Minnesota.

Montalvo, Jose G. and Marta Reynal-Querol (2005) “Ethnic diversity and economic development,” *Journal of Development Economics* 76: 293-323.

Ong’wen, Oduor (2010) Ethnicity in relation to conflict over control and accessed to natural resources in Africa: The case of Kenya. Paper presented at Yale Workshop on Ethnic Diversity and Economic Instability in Africa (January 16-17), Yale University.

Oucho, John O. (2002) *Undercurrents of Ethnic Conflict in Kenya*, Leiden, Brill.

Ranis, Gustav (2009) Diversity of communities and economic development: an overview, Paper presented at Kobe Conference on Ethnic Diversity and Economic Instability in Africa (July 13-14), Kobe University.

Shipton, Parker (2009) Ethnicity, economy, and mobility, Paper presented at Kobe Conference on Ethnic Diversity and Economic Instability in Africa (July 13–14), Kobe University.

Stewart, Frances (2010) “Horizontal inequalities and conflict: an introduction and some hypothesis,” in Frances Stewart ed. *Horizontal Inequalities and Conflict*, New York, Palgrave Macmillan: 3-24.

Taylor, Charles Lewis and Michael C. Hudson (1972) *The World Handbook of Political and Social Indicators*, 2nd. Edition, New Haven, CT, Yale University Press.

UNDP (2006) *Kenya National Human Development Report 2006*, Nairobi, UNDP.

Venables, Anthony (2010) “Economic geography and African development,” *Papers in Regional Science* 89: 469-483.

Appendix: Variable definition

pov_ratio: headcount ratio under the poverty line reported in Kenya National Bureau of Statistics, *1999 Census of Population and Housing*.

pc_income: natural logarithm of GDP per capita in 2005 reported by UNDP (2006), Appendix i.

road: dummy representing districts lying on international trunk ("class A") roads.

no_edu: ratio of persons 15 years and older without completing primary education, calculated from microdata of the Kenya National Bureau of Statistics, *1999 Census of Population and Housing*, obtained from IPUMS-I (Minnesota Population Center, 2010).

adult_illiteracy: 1 minus the adult illiteracy ratio of 2005, as estimated by UNDP (2006), Appendix i.

fractionalization: measure of ethnic diversity calculated using the formula of $1 - \sum_i s_{ij}$ by Taylor and Hudson (1972), where s_{ij} stands for the share of *i*th ethnic group (tribe) in district *j*. Data of ethnic composition at district-level is obtained from Central Bureau of Statistics, *Kenya Population Census 1989.*

polarization: measure of ethnic polarization using the formula $4\sum_{i=1}^{N}\sum_{i\neq j}(s_i)^2 s_j$ introduced by Montalvo and Reynal-Querol (2005).

Nyanza, ***Rift Valley***, and ***Central*** are regional dummies representing districts belonging to respective provinces. ***Nairobi_Central*** includes Nairobi.

Table 1. Summary statistics

Variable	Mean	Std. Dev.	Min	Max
pov_ratio	0.5411905	0.1218208	0.2171581 (Kiambu)	0.808475 (Kuria)
pc_income	6.528851	0.7000979	5.135798 (Wajir)	8.303505 (Nairobi)
no_edu	0.6348116	0.1370097	0.2862105 (Nairobi)	0.9429141 (Mandera)
adult_illiteracy	0.3375797	0.1520748	0.111 (Mombasa)	0.826 (Marsabit)
Fractionalization	0.3430435	0.2493434	0.03494 (Nyamira)	0.86518 (Mombasa)
Polarization	0.4429359	0.2324567	0.0684938 (Guhca)	0.839626 (Busia)

Table 2. Regression results with regional dummies

	pov_ratio		*pov_ratio*		*pc_income*		*pc_income*	
Road	-0.040154	**	-0.0354573	**	-0.0338705		-0.07589	
	(0.0161025)		(0.0149134)		(0.1714399)		(0.1720885)	
no_edu	0.2344886	***	0.2394624	***				
	(0.055839)		(0.0485739)					
adult_illiteracy					-1.22584	*	-1.140387	**
					(0.65434)		(0.5582955)	
fractionalization			-0.0927405	***			0.8152888	**
			(0.032022)				(0.3860441)	
Polarization	-0.054102				0.4190911			
	(0.0412469)				(0.3717827)			
Nyanza	0.0948081	**	0.0844276	***	-0.0723709		0.0258334	
	(0.029431)		(0.0294909)		(0.1925601)		(0.1814985)	
Rift Valley	-0.0939295	***	-0.0976902	***	0.0072516		0.0252957	
	(0.0181776)		(0.0169064)		(0.2207658)		(0.2161774)	
Central	-0.2260062	***	-0.2383974	***				
	(0.0262816)		(0.0258739)					
Nairobi_Central					0.507424	*	0.5954395	***
					(0.2847261)		(0.2247545)	
Constant	0.4699371	***	0.4760187	***	6.728047	***	6.59691	***
	(0.0479139)		(0.0428439)		(0.3338173)		(0.2753026)	
R-squared	0.7332		0.7541		0.1708		0.2282	
Prob. > *F*	0		0		0.0103		0.0002	
Observation	69		69		69		69	

*** 1%, **5%, *10%. Robust standard errors are shown in parentheses.

Table 3. Regression results with spatial correlation

	pov_ratio		*pov_ratio*		*pc_income*		*pc_income*	
Road	-0.0458996	**	-0.0409929	**	0.0118628		-0.0231559	
	(0.0192405)		(0.0183548)		(0.1637239)		(0.1563547)	
no_edu	0.167372	**	0.1798538	**				
	(0.0836058)		(0.0827373)					
adult_illiteracy					-1.540431	***	-1.52936	***
					(0.5801538)		(0.4984949)	
fractionalization			-0.0884833	**			0.7536241	**
			(0.0393338)				(0.3587953)	
Polarization	-0.0595084				0.2789139			
	(0.0371971)				(0.3020793)			
*W*pov_ratio*	0.9586826	***	0.9658064	***				
	(0.1403531)		(0.1299536)					
*W*pc_income*					0.1777369		0.2890305	
					(0.2745791)		(0.2589353)	
Constant	-0.0238925		-0.0343925		5.771954	**	4.935014	***
	(0.0735505)		(0.0746591)		(1.855182)		(1.749749)	
R-squared	0.5725		0.5912		0.1305		0.1901	
Prob. > *F*	0		0		0.0609		0.0047	
Observation	69		69		69		69	

*** 1%, **5%, *10%. Robust standard errors are shown in parentheses.

Table 4. Regression results with ethnicity-weighted spatial correlation

	pov_ratio		*pov_ratio*		*pc_income*		*pc_income*	
Road	-0.043895	**	-0.042358	**	-0.016126		-0.039841	
	(0.0204129)		(0.0195607)		(0.157504)		(0.1500607)	
no_edu	0.1874827	**	0.1990724	**				
	(0.0829944)		(0.0866672)					
adult_illitearcy					-1.428324	***	-1.465143	***
					(0.5187375)		(0.4698105)	
fractionalization			-0.032579				0.6030055	*
			(0.0412908)				(0.3393688)	
Polarization	-0.010317				0.1961421			
	(0.039874)				(0.2852494)			
*E*W* pov_ratio*	0.6861334	***	0.6777612	***				
	(0.1064225)		(0.1057059)					
*E*W* pc_income*					0.4395456	***	0.4222738	***
					(0.1560752)		(0.159973)	
Constant	0.0908942		0.0936748		4.089088	***	4.106704	***
	(0.0703801)		(0.0700019)		(1.064078)		(1.075231)	
R-squared	0.5419		0.5457		0.2172		0.2585	
Prob. > *F*	0		0		0.0015		0.0005	
Observation	69		69		69		69	

*** 1%, **5%, *10%. Robust standard errors are shown in parentheses.