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Empirical Study on Industrial Cluster in Africa, the Role of Space, Infrastructure, Human Resource and Social Capital

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Location Choice and Performance of Furniture Workshops in Arusha, Tanzania

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Abstract

This study uses data collected in an emerging furniture cluster in the Tanzanian city of Arusha to investigate the determinants of location choice and location effect on the performance of micro and small furniture enterprises in Africa. Based on empirical analyses of a census of 234 workshops located in five sub-clusters, the results show that furniture producers tend to locate in sub-clusters where industrial peers from their own ethnic group have gathered. Meanwhile, the results, consistent with the literature on agglomeration economics, shows that entrepreneurs in Africa desire to locate in proximity to a large output market. However, performance analyses show that ethnic networks did not contribute to the performance of workshops as measured by DEA and product quality. In contrast, workshops located in sub-clusters with more machinery shops outperformed workshops located in sub-clusters with fewer machinery shops, implying that well-integrated upstream industries in the sub-cluster foster the development of the industry.

Keywords: Industrial Cluster, Location choice, Ethnicity, Africa.

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1. Introduction

The development experience of East Asia shows that, in order for growth to lead to poverty reduction, poor people should have broad access to economic opportunities, whether by migrating to find a job or by starting their own businesses. Many prominent indigenous firms in East Asia were micro-enterprises when they were established. The massive new entry of similarly small enterprises was the engine of growth in the early stage of the development of these industries. In the later stages, a relatively small number of enterprises succeeded in improving their products, branding them, introducing new marketing methods and procurement channels, and upgrading management, thereby drastically improving productivity. Successful firms expanded not only through productivity gains, but also through mergers and by forcing inefficient firms to exit. As a result, the number of enterprises in an industry might have decreased, but the industry as a whole grew rapidly (Sonobe and Otsuka, 2006). This dynamic process was largely observed in industrial clusters, in which enterprises benefited from positive externalities arising from the agglomeration of a number of firms producing similar and related products. Government support for such clusters in East Asia often took the form of infrastructure provision to clusters such as through the improvement of road networks, water supply, and electricity. As a result, the profile of firms located in East Asia is now quite diverse, including a large number of indigenous firms.

In contrast, industrial development in Africa is far less dynamic and almost completely dominated by foreign direct investment (FDI) and ethnic minority firms, for instance, by Indians in East Africa. If we focus on the indigenous part of African industries, the contrast in dynamism between East Asia and Africa is more striking. Nonetheless, the two regions share one feature of industrial development: both are cluster-based. The majority of indigenous enterprises in Africa are located in clusters (McCormick, 1999). The reasons for this observation have been further examined by some economists, such as Schmitz and Nadvi (1999), Sonobe and Otsuka (2006), and Ruan and Zhang (2009). They argue that industrial

clusters reduce transaction costs and increase collective efficiency through community mechanisms and social networks. Their arguments are mostly based on the results of case studies in Asia and South America. To complement the literature, this study examines this argument with respect to the African economy. A growing number of studies discuss the effect on economic behavior of social capital, such as the norms, relationships of trust and networks generated in ethnic groups and communities. According to the literature, the benefits of social capital do not necessarily extend to those outside the network or community (e.g., Putnam 2000; Hayami 2009). The question then arises as to the role that social capital plays in shaping Africa's economic landscape. On this and related issues, important studies such as Fafchamps (2003, 2004) have been conducted. Fafchamps (2003) finds it is easier for a member of a particular group to enter an economic market in Africa.

The paper contributes to the literature on agglomeration economics by exploring the role of ethnic networks in the development of industrial clusters in Africa. This paper considers where furniture producers tend to locate and whether their locational choices affect productivity. A data set that the authors collected through a census of 234 workshops in the furniture clusters of Arusha, Tanzania, was used in this analysis since all the owners of furniture workshops located in the clusters were interviewed and the location of these workshops was identified using a Global Positioning System (GPS). A major and unique finding is that ethnic networks predict the choice of location of furniture producers. In other words, furniture entrepreneurs in Africa tend to locate their workshops in sub-clusters where industrial peers from their own ethnic group have also located. Consistent with the literature on agglomeration economics, our results also show that entrepreneurs desire the proximity of large-scale industrial peers. However, while ethnic networks encourage entrepreneurs to locate themselves in the sub-clusters, these networks do not necessarily enhance business performance as measured by Data Envelopment Analysis (DEA) and the quality of the products, i.e. the degree of dryness of the wooden products. The results show that furniture

workshops located in sub-clusters with a sufficient number of wood processing shops outperformed workshops located in sub-clusters without such shops. This finding suggests that the degree of specialization and division of labor in an industrial cluster is critical for the development of such industry clusters.

The remainder of the paper is organized as follows. Section 2 reviews the agglomeration economics literature. Section 3 documents furniture clusters in Arusha, Tanzania, and develops empirical hypotheses. Section 4 presents a methodology to test these hypotheses and presents the survey data. Section 5 reports the results of empirical analyses. Section 6 give conclusions for the results and presents policy implications.

2. Literature review

Enterprises are attracted to industrial clusters due to the possibilities for higher profitability within the clusters. As originally discussed by Alfred Marshall in 1920, being located in proximity to other enterprises leads to an improvement in productivity that results from three positive externalities generated in an agglomeration economy: knowledge spillover, labor market pooling, and specialized intermediate inputs and services

Schmitz and Nadvi (1999), Sonobe and Otsuka (2006), and Ruan and Zhang (2009) argue that industrial clusters reduce transaction costs and increase collective efficiency. Owing to their geographical proximity, information about the technological capacities of individual enterprises in a cluster, their marketing behavior, and the conduct and personality of individual enterprise owners is public knowledge within the cluster. On the other hand, if an owner's reputation is questionable, the enterprise will lose customers and may eventually face bankruptcy.

From the aspect of economic costs, the economic geography literature provides a framework illustrating why economic activities tend to concentrate in certain geographical locations. The basic assertion is that transportation costs resulting from the distance that links

input resources, the firm's location and the market can lead industries to agglomerate in certain areas to capture the positive externalities arising from economies of scale and agglomeration (Fujita and Thisse, 2002).

LaFountain (2005) proposed three models for the exploration of different drivers leading to the choice of locating within industrial clusters: 1) a production externality model stressing the desire of firms for proximity to other similar firms for seeking the benefit of knowledge spillovers 2) market access models emphasizing the desire of firms for proximity to their customers, and 3) a natural advantage model highlighting the desire of firms for proximity to production inputs. He used data on manufacturing firms in the US for the 1980s and 1990s, and his results suggest that the furniture industry is weakly consistent with the predictions of both the natural advantage model and the production externality model.

In the context of economic development, the economic geography framework provided by industrial agglomeration needs to be augmented with other factors, particularly transaction costs. Transaction costs are high in developing economies, particularly in Africa. Market failures are caused by incomplete contracts, information asymmetry, and the lack of appropriate institutions to mitigate such market failures. In developing countries, people seek out social networks such as their friends, relatives and members of the same ethnic group to reduce transaction costs since such relationships operate on the basis of trust among the members. Usually, social networks facilitate information flow and Fafchamps (2003), for instance, found that it was easier for a member of a particular social group to enter a market in Africa. The literature on labor markets in Africa (Barr and Oduro, 2002) suggests that ethnic networks facilitate information flow on job opportunities.

So far, few studies have investigated how entrepreneurs determine their choice of business location in industrial clusters, particularly for micro and small enterprises located in naturally formed industrial clusters in Africa. We argue that entrepreneurs in Africa might exhibit behavior that is different from other regions in their selection of location. In addition to

the models such as those proposed by LaFountain (2005), as mentioned above, ethnic networks may affect location choices made by African entrepreneurs and eventually their business performance

3. Arusha and the furniture industry

Arusha is the third largest city of Tanzania, following the largest city Dar Es Salaam and Mwanza. As it serves as an important transportation hub, directly linked by main roads, including international roads to Kenya, the population has been growing rapidly, and showed the highest growth rate in the country of 6.4 percent in 2002 (Tanzania National Bureau of Statistics, 2002). The city is surrounded by Mounts Moshi and Meru and famous national parks such as Serengeti, Ngorongoro Crater, and the highest mountain in the African continent, Mt. Kilimanjaro, and has been attracting a large number of foreign visitors, in particular since 2000. Owing to the rich natural resources derived from Mt. Moshi and Meru, the furniture industry in the area has been rapidly growing with the increase in demand for furniture not only from residential housing, but also from the hotel and construction industries.

In addition, Arusha Technical College (ATC)[1] and a Vocational Training and Service Centre (VTSC) are located in the Arusha area. The former was established in 1978 and provides both engineering and managerial skills, while the latter was established in 1998 and mainly focuses on providing engineering skills to prospective students in Northern Tanzania (Arusha, Tanga, and Kilimanjaro regions). Both of them train carpenters for the industry in the area.

The furniture workshops of Arusha are mainly located in five sub-clusters within the municipal area. They are: 1) Nairobi-Moshi, 2) Sokoine Road–Arusha Tech, 3) City Center, 4) Dodoma-Oljoro Road, and 5) the Industrial Area. In 2007, JICA conducted a census of face-to-face interviews on the cluster-based furniture workshops in the area. As a result, the

[1] Formerly (1978-2006) the Technical College Arusha

population is comprised of 234[2] furniture workshops. Overall, as shown in Figure 1, the furniture industry in Arusha has been increasing since 2000, experiencing a wave of new entries in the period 2005–2007. In terms of geographical distribution, of the 234 enterprises in the year 2007, 77 were located in the Nairobi-Moshi Area, 45 in the Dodoma-Oljoro Road area, 44 in the City Center, 38 in the Industrial Area, and 30 in the Sokoine Road–Arusha Tech area (See Table 1 and Appendix 1).

These five sub-clusters are distinctive in terms of their geographical characteristics even though most furniture workshops follow a similar process for producing a piece of furniture. Firstly, they take an order from a customer. A few of them use certain marketing methods such as radio advertisements, but the majority just wait for someone to stop by at the workshop. After taking the order, the workshops purchase the timber from a timber shop in the area, using the advanced payment from the customer. As most furniture workshops do not possess machines to cut the timber into components, they bring the timber to a neighboring machinery shop. A lack of capital does not allow the workshops to purchase a machine, but the instability of the electricity supply, which would reduce its frequency of use, could be another of the main reasons why the workshops do not possess one. All the components are brought back to the workshops and the carpenters assemble the furniture and sand the edges. Once the furniture is made, it is usually the customer who picks it up and transports it.

The Nairobi-Moshi Area refers to the sub-cluster along the international road that links Moshi to Nairobi. Beyond Moshi, it is connected to the largest Tanzanian city of Dar es Salaam. The heavy traffic along the Nairobi-Moshi international road indirectly brings a large number of potential customers to the sub-cluster-based furniture workshops. New entrants to the furniture industry, in turn, swarm to the area in the desire to be close to the customers. As a result, not only the greatest number of furniture workshops, but also the largest furniture

2 A state-owned furniture factory is located in the area. However, the furniture factory is run by Arusha-Moshi prison and its workers are prisoners who have served their sentence in jail. This factory possesses relatively advanced equipment. Due to its uniqueness, we excluded it from our observations.

workshops can be seen in the area. Of the 77 workshops, almost a half of them are owned by members of the Chagga ethnic group (See Table 1). In addition, owing to the expanding number of furniture workshops, machinery shops are more frequently observed in this area compared to other sub-clusters.

The Dodoma–Oljoro Road area refers to the sub-cluster located along Dodoma Road connecting Arusha municipality with central inland Tanzania. This area attracts customers from newly developed residential areas within the Arusha municipality and some nearby rural towns. Therefore, following the Nairobi-Moshi Area, the Dodoma-Oljoro Road area has grown since 2000 to be the second largest sub-cluster.

The City Center refers to a sub-cluster around the old city center market, with small-scale workshops scattered within residential and commercial areas. Since machinery shops for wood processing are not allowed by law to become established in the area, the City Center cluster-based furniture workshops are therefore expected to use machinery shops outside the area. Nevertheless, in interviews, we still observed several machinery shops hidden behind hedges.

The Industrial Area refers to the sub-cluster around the industrial zone that was constructed by the government near the old railway station on the railway connecting Dar es Salaam and Zambia. The sub-cluster is not directly linked to other areas by the main roads of Arusha, but has good access to the main roads, and the road networks within the sub-cluster are relatively advanced compared to the other four sub-clusters. Meanwhile, the industrial area includes a variety of industries from food processing to chemical industries. In the area, a scattering of furniture workshops can be observed and these workshops apparently vary in size. Some large furniture workshops are located on sizable land lots, while many new workshops were only able to locate themselves on small corner sites. Although this sub-cluster is growing slowly in terms of the number of workshops compared to other sub-clusters, it was observed that several seasoned furniture producers have remained in the area. More surprisingly,

order-sharing is more prevalent in the area, while this is rarely observed in the other sub-clusters.

The Arusha Tech-Sokoine Road sub-cluster is an area connecting a corner of the Nairobi-Moshi Road with the Sokoine Road (a main road passing through the center of Arusha municipality). This area attracts visitors who use both the Nairobi-Moshi Road and the Sokoine Road, and it was the sub-cluster that was most densely populated in terms of furniture workshops in 2007. Surprisingly, furniture producers located in this sub-cluster stated that they spent a longer time waiting for wood processing compared to the other sub-clusters. Apparently, this area lacks supportive upstream industries for the furniture industry.

According to the 1998 Socio-Economic Profile data , the majority ethnic groups in the Arusha region are Iraqw, Arusha, Maasai, Meru, and Bargaig, while the minority groups are Sonjo, Gorowa, Rangi, Chagga, Pare, and Nguu. The Meru and Arusha predominate in Arusha municipality. Contrary to the Socio-Economic Profile data, our data for furniture workshops in the same area show that the Chagga tribe predominates (41%) in the furniture industry, followed by the Pare (12%), Sambaa (6%), and Meru (4%). This over-representation might imply that furniture producers tend to locate their business in sub-clusters where their ethnic groups are concentrated and such networks could eventually contribute to superior performance.

Taking advantage of a census dataset on the five sub-clusters in Arusha, Tanzania, we explored the key determinants of locational choice by enterprises in Africa, and the effect of sub-cluster choices on the performance of enterprises. Four hypotheses were postulated as follows.

H1: The degree of concentration of workshops predicts the choice of sub-cluster for new-entry workshops.

H2: Ethnic networks predicts the choice of the location of workshops.

H3: The performance of workshops located in sub-clusters with a higher concentration of

workshops is better than that of workshops located in sub-clusters with a lower concentration of workshops.

H4: The performance of workshops located in sub-clusters with a larger percentage of members from fellow ethnic groups among the other workshops is higher than for workshops located amid workshops where there are fewer members of the same ethnic group.

4. Methodology and Data

This section first introduces the conditional logit model used to test hypotheses 1 and 2 regarding choice of location. Second, it discusses DEA, the dryness of the wooden products, used to measure the performance of the enterprise. Finally, OLS regression is used to examine hypotheses 3 and 4.

4.1 Location choice

In estimating the determinants of location choice, it is necessary to start with individual decisions on location. As mentioned in Section 3, there are five primary sub-clusters in the Arusha municipality. Following the prior literature, location choices are treated as being independent of one another, using a multinomial choice model for the analysis. Because our research interest is to explore the cluster characteristics that attract entrepreneurs, rather than to come to conclusions about the attributes of entrepreneurs located in the clusters, from several alternative multinomial logit models, the conditional logit model framework was selected. The probability of observing enterprise i choosing alternative sub-cluster j is as follows.

$$P_{ij} = \frac{\exp(X_{ij}\beta)}{\sum_{K=1}^{J} \exp(X_{ij}\beta)}$$

i=1...129 (new entrants between 2005 and 2007)

j=1...5

Where X_{ij} stands for the characteristics of the workshop i changing across sub-cluster j, with common parameter vector β of Sub-cluster characteristics

Individual workshops were taken as the unit of analysis and the averages of the workshop characteristics in the five sub-clusters were used as proxy variables for the sub-cluster characteristics. More specifically, the sub-cluster variables were calculated based on the average characteristics of the workshops located in that sub-cluster in the year 2004. Of the 234 workshops existing in 2007, 105 were established in the period up to and including 2004 and 129 started up during the 2005–2007 period. A model was estimated of the choice of location made by the 129 furniture entrepreneurs[3].

To investigate the factors that enhance the probability of newcomers locating themselves in a particular sub-cluster, several variables were included in regressions to capture the characteristics of the sub-clusters. Two principal factors concerning our hypotheses are the degree of concentration of workshops (agglomeration) and the proportion of industrial peers who were from the same ethnic group as the new entrant in each sub-cluster. The former, denoted by Concentration of the workshops, is calculated as the number of workshops divided by the area of the sub-cluster (see Table 2). The latter variable of Percentage of other producers having the same ethnicity, calculated as the ratio of the number of owners sharing the same birth language as the prospective owner of a workshop in the sub-cluster to the total number of

[3] Note that as for explanatory variables we use 2004 data since we assume that location choices made between 2005 and 2007 are made based on the observations of the base year (2004). People may argue that the variables for 2004 are underestimated, as the information for 2004 was obtained in the 2007 survey. As for this concern, we infer through the interviews that prior to the year 2004, the furniture market was not as competitive as it is today; the entering and leaving of the market were rarely observed.

workshops in the sub-cluster, is used to capture effect of ethnic networks on the choice of location.

In addition to these two variables, factors that are considered to affect the choice of location by entrepreneurs were also included (see Table 3). These are the Scale of production calculated as a summed value of the products in each sub-cluster; Number of visitors measured by the average of number of visitors. The term visitor rather than customer is used because the question to interviewees was how many people in total visit your shop per day. The other factors are the Driving time to obtain timber resources (Access to timber), and the Waiting time for the processing of the timber (Processing time), computed as the average waiting time for wood processing by a machinery shop. This latter factor is expected to capture the effect of upstream support industries (specialization and division of labor) whereas it is omitted in the locational analysis due to collinearity with the Number of visitors. It was conjectured that this comes from the fact that most machinery shops are located where there are large crowds of people.

The variables, Concentration of the workshops and Scale of production are both expected to capture the information spillover effect generated in industrial clusters. While the former is used to find out the geographical concentration of the workshops, the latter is expected to capture the business scale of the workshops. Analysis of the pairwise correlation shows that the correlation of these two variables is negative, indicating that a sub-cluster with a higher number of workshops probably does not contain large-scale workshops. If furniture producers seek information sharing from neighboring producers, a significantly positive coefficient of the Concentration of the workshops can be observed in the regression analyses. On the other hand, if furniture producers seek information spillovers from large workshops, a significantly positive coefficient of the Scale of production can be observed.

4.2 Performance

The performance of the workshops is measured by two indices, total efficiency and the quality of the product. Total efficiency is measured by DEA and is further decomposed into two components (i.e., technical efficiency and allocative efficiency)[4]. The three inputs and one output used in the DEA calculations are summarized in Table 5. The input of raw materials is measured as the expenditures on timber, screws, sanding and polishing materials, and so on. Labor expenditures are the sum of the costs of permanent and temporarily hired workers. The capital input is computed as the land rent[5]. The output is measured as the summed values of the products. On the other hand, the quality of the products is measured by the dryness of the wooden products. This information is obtained by gauging the moisture content of the wooden products using an aquameter.

The performance of individual enterprises is measured by Data Envelopment Analysis (DEA). This nonparametric method was provided by Farrell (1957) and developed by Fare, Grosskopf, and Lovell (1985, 1994). The basic concept of input-oriented DEA is briefly illustrated by the distance function shown in Figure 2. The unit M' lying on the isoquant represented by I I' is the technically efficient enterprise, representing the firm that uses a combination of the fewest inputs to produce the highest level of output among the observed enterprises. Likewise, the unit M'' lying on the isoquant represented by AA' is the allocatively efficient enterprise, representing the firm that uses the inputs in optimal proportions, given their respective prices.

If a given enterprise uses multiple quantities of inputs, defined by point M, to produce a unit of output, it is defined as an technical inefficient enterprise compared to the M' enterprise, and allocative inefficient enterprise compared to the M'' enterprise. The DEA of M enterprises can be decomposed into technical inefficiency and allocative inefficiency.

[4] Total efficiency, technical efficiency, and allocative efficiency were estimated using DEAP 2.1 software, which was developed by Coelli (1996)

[5] Ownership of land belongs to the government in Tanzania. People lease and pay land rent for where they live.

Technical inefficiency is presented by the distance MM', which suggests that the inputs could be reduced without a reduction in output. The technical efficiency (TE) of an enterprise is measured as the ratio of the distance 0M' to the distance 0M. Therefore, TE is expressed as:

$$TE_i = OM'/OM$$

TE ranges from 0 to 1, where a value of 1 indicates technical efficiency.

In addition to TE, the other decomposition of the DEA, allocative efficiency (AE), is measured as the ratio of the distance 0M''to the distance 0M'.

$$AE_i = OM''/OM'$$

Total efficiency (CE) is calculated by technical efficiency multiplied by allocative efficiency. Hence, CE is measured as follows:

$$CE_s = TE_s \times AE_s = OM''/OM$$

The total efficiency (CE) is calculated from its two components: technical efficiency (TE) and allocative efficiency (AE). With respective to product quality, the dryness of the timber input into the finished product is used.

5. Empirical Results

A. Determinants of location choice

Table 4 presents the results of considering the choice of location for the sub-cluster of furniture entrepreneurs. Specification (1) covers the three variables of the scale of production, the number of visitors, and access to timber supplies to capture the knowledge spillover effect,

market access effect, and natural advantage effect, respectively. The results of specification (1) indicate a production externality model; the knowledge spillover benefit can explain the behavior of the entrepreneurs in the selection of a location for their business. Specification (2) only covers the Concentration of workshops and the Percentage of other producers having the same ethnicity to examine hypotheses 1 and 2. The coefficient for the Percentage of other producers having the same ethnicity is significantly positive, suggesting that if a high percentage of other producers share the same ethnic culture as any newcomer, this encourages the newcomer to become established in that location. This result supports our hypothesis 2 that ethnic networks can be predictive of the choice of location by entrepreneurs. However, the coefficient for the Concentration of workshops is not significant, indicating that hypothesis 1 is not evident. This result suggests that furniture producers in the area do not locate where their industrial peers are geographically highly concentrated. AIC and BIC values indicate that specification (2) is superior to specification (1). However, since specification (1) implies that, just as entrepreneurs in other regions, entrepreneurs in Africa desire the knowledge spillovers that are generated in industrial clusters, the inference is that African entrepreneurs seek to locate where there are large-scale workshops, rather than where workshops are geographically concentrated. Thus, we added Scale of production as specification (3). The results confirm our assertion, and the goodness of fit also supports the conclusion that the specification (3) is superior. When including the Number of visitors and Access to timber in specification (4), similar results were obtained to those for specification (3), while this decreased the degree of the goodness of fit. A large Number of visitors to the sub-cluster reduces the probability that new entrants will decide to locate themselves in the sub-cluster, but this factor is not significant. The greater the length of driving time for the transportation of material inputs, represented as Access to timber, decreases the probability of a location being chosen, but again this is not to a significant extent.

Overall, the results show that the Percentage of other producers having the same

ethnicity predicts the behavior of furniture producers in the selection of the location for their workshop. This evidence supports our hypothesis 2 and confirms the Fafchamps' (2003) findings that it is easier for a member of a particular group to enter economic markets in Africa. On the other hand, despite it being not significant, the negative indication of coefficients for Concentration of the workshops in specifications (2) (3) and (4) is a completely opposite result from what was expected. A positional reason for this may that a greater degree of concentration of the workshops could also indicate a higher degree of geographic congestion, which is not a favorable factor for the business activities of furniture workshops. Estimates of the Scale of production are significantly positive across specifications (1) (3) and (4), suggesting that African entrepreneurs, similar to those in other regions, tend to locate where large workshops gather. Clearly, new entrants to industrial clusters seek proximity to a production externality while avoiding geographical congestion.

To sum up, the Percentage of other producers having the same ethnicity and the Scale of production are significant explanatory variables for the choice of business location by furniture workshops. These results reject the first hypothesis that Concentration of the workshops predicts the choice of sub-cluster, but support the second hypothesis that ethnic networks predict the choice of location.

B. Performance analyses

Of the 226 enterprises for which it was possible to calculate efficiency, the enterprises considered most cost efficient are located in the Industrial Area[6] sub-cluster. Overall, the average total efficiency (CE) is 0.102, where the average technical efficiency (TE) is 0.156 and allocative efficiency (AE) is 0.68. A value of one indicates that the firm is the most efficient within its cluster. An average TE 0.156 is extremely low, indicating that furniture workshops in Arusha did not efficiently use the inputs in production. This result is consistent with what we

[6] The DEA estimates of individual workshops are presented in Appendix 2.

observed in the fieldwork where the timber input by plenty of producers was out of proportion to the finished products. On the other hand, we also observed a few workshops located in the Industrial Area sub-cluster and the Nairobi-Moshi Road sub-cluster that had their own wood processing machines, who were therefore technologically competitive in their production. As presented in Table 6, of the five sub-clusters, the Industrial Area sub-cluster produced the best total efficiency of 0.143, followed by the Nairobi-Moshi Road sub-cluster at 0.116, the City Center with 0.094, Dodoma Road with 0.093 and Sokoine Road with 0.08. It can be inferred that, although the Industrial Area sub-cluster has been shrinking in terms of the number of workshops since 2000, active collaboration between the furniture producers, such as through order sharing, and their proximity to a variety of other supportive industries has led to a higher allocative efficiency of the furniture workshops in the sub-cluster.

In the performance analyses, regressions were carried out of four performance measurements on the attributes of the entrepreneurs, the characteristics of the workshops and the sub-clusters. The attributes of the entrepreneurs are age, squared age, education, previous occupation. As for the characteristics of the workshops and sub-clusters, in addition to those variables covered in the location choice analyses, years of operation and waiting time for wood processing were also included.

The results presented in Table 7 show that the variable of Furniture seller before is negatively related to CE, but positively related to Dryness. This implies that furniture producers who were furniture sellers showed inferior performance in terms of total efficiency, but superior performance in terms of product quality. Surprisingly, furniture producers who were spin-offs from furniture factories performed worse in both total efficiency and technological efficiency. Highly educated producers showed better performance in technological efficiency and product quality, but worse performance in allocative efficiency. A longer waiting time for wood processing has a negative impact on production efficiency and product quality. This implies that upstream activities in the production chain are crucial to the

performance of furniture workshops in Arusha. The scale of production of the sub-clusters is negatively associated with the allocative efficiency of the workshops. This is contrary to the conventional wisdom that workshops benefit from being located in industrial clusters with a greater number of large-scale industrial peers. A potential reason for this is that even if sub-clusters such as Nairobi-Moshi Road and Sokoine Road contain some large-scale workshops, we observed less order-sharing and labor sharing between the workshops within these two sub-clusters. It can be inferred that the reduced amount of information sharing among workshops in these sub-clusters results in a misallocation of inputs and outputs.

The Percentage of other producers having the same ethnicity does not affect any of the performance measurements that were examined in Table 7, thus neither hypothesis 3 nor hypothesis 4 is evident.

Overall, the characteristics of the sub-clusters have little impact on the performance of the workshops. Although a higher Percentage of other producers having the same ethnicity and a greater Scale of production make the sub-clusters attractive to furniture producers, they do not contribute to a higher total factor efficiency or product quality. On the contrary, the development of supporting industries is necessary for the amplification of the productivity of furniture workshops. In the context of Arusha, a long waiting time for wood processing occurring at machinery shops is often caused by shortages of electricity supply. We therefore interpret the results as suggesting that infrastructure improvements can foster the development of the furniture industry in Arusha. In the meantime, education is important to a high quality of product.

6. Conclusions and Policy Implications

Using data on an emerging furniture cluster in Tanzania, we explored the determinants of location selection and performance of micro and small furniture workshops located in industrial clusters in African countries. Our findings imply that furniture producers tend to

locate themselves in a sub-cluster where the product market is large. Uniquely and interestingly, they tend to locate their business in a sub-cluster where industrial peers from their own ethnic group have gathered. However, while ethnic networks do not contribute to performance, a short waiting time for wood processing, i.e., a higher degree of specialization and division of labor, enhances total efficiency and product quality. These results suggest that ethnic networks predict the formation of industrial clusters in African countries; however, such networks do not necessarily lead to better performance. Consistent with conventional evidence, our results show that well-integrated upstream industries facilitate the development of the industry.

The above may be the best strategy for a furniture workshop if its market is not fastidious about product quality. However, as the population of Arusha municipality and other rural towns in Tanzania grows, consumers may start demanding a greater variety and better quality of products as well as pursuing low prices. Although it is unclear how the growth strategy for any furniture workshop will change at that stage, according to the literature, only innovative entrepreneurs can survive. It could be the case that improved efficiency and product quality through training are the key to sustained growth. These issues are left to future research.

References

Barr, A., and Oduro, A. 2002. Ethnic fractionalization in an African labour market. *Journal of Development Economics* 84: 335-79.

Barkley, D., and M. Henry, Rural industrial development: To cluster or not to cluster? *Review of Agricultural Economics* 19: 308–25.

Biesebroeck, J. 2005. Firm size matters: Growth and productivity growth in African manufacturing. *Economic Development and Cultural Change* 53: 545–83.

Coelli, T., 1996. *A guide to DEAP Version 2.1: A data envelopment analysis (computer) program*. University of New England, Amidale.

Evans, D. 1987. Tests of alternative theories of firm growth. *Journal of Political Economy* 95: 657–74.

Friedman, J., D. Gerlowski, and J. Silberman. 1992. What attracts foreign multinational corporations? Evidence from branch plant location in the United States. *Journal of Regional Science* 32: 403–18.

Fafchamps, M. 2003. Ethnicity and networks in African trade. *Contributions to Economic Analysis and Policy* 2, art. 14.

http//www.bepress.com/bejeap/contributions/vol2/iss1/art14

Fafchamps, M. 2004. *Market institutions in Sub-Saharan African*. Cambridge: MIT Press.

Fare, R., S. Grosskopf, and C.A.K. Lovell. 1983. The structure of technical efficiency. *Scandinavian Journal of Economics* 85: 181–90.

Fare, R., S. Grosskopf, M. Norris, and Z. Zhang. 1994. Productivity growth technical progress, and efficiency change in industrialized countries. *American Economic Review* 84: 66–83.

Farrell, M.J. 1957. The measurement of productive efficiency. *Journal of the Royal Statistical Society* 120: 253–90.

Fujita, M., and JF Thisse. *Economics of agglomeration: Cities, industrial location and regional growth*. Cambridge: Cambridge University Press.

Hayami, Y. 2009. Social capital, human capital and the community mechanism: Toward a conceptual framework for economists. *Journal of Development Studies* 45: 96–123.

Head, K., and T. Mayer. 2003. *Market potential and the location of Japanese investment in the European Union*. CEPR Research Network on The Economic Geography of Europe: Measurement, Testing and Policy Simulations.

LaFountain, C. 2005. Where do firms locate? Testing competing models of agglomeration. *Journal of Urban Economics* 58: 338–66.

Markusen, A. 1996. Sticky place in slippery space: A typology of industrial districts. *Economic Geography* 72: 293–313.

McCormick, D. 1999. African enterprise clusters and industrialization: Theory and reality. *World Development* 27: 1531–51.

Marshall, A. 1920. *Principles of economics*. London: Macmillan.

Putnam, R. D. 2000. *Bowling alone*. New York: Simon & Schuster.

Rauch, J., and V. Trindade. 2002. Chinese networks in international trade. *The Review of Economics and Statistics* 84. 116–30.

Rosenfeld, S. 1992. *Competitive manufacturing: New strategies for regional development*. New Jersey: Center for Urban Policy Research.

Ruan, J., and X. Zhang. 2009. Finance and cluster-based industrial development in China: Economic development and cultural change. *University of Chicago Press* 58: 143–64.

Schmitz, H., and K. Nadvi. 1999. Clustering and industrialization: Introduction. *World Development* 27 (9): 1503–14.

Sonobe, T., and K. Otsuka. 2006. *Cluster-based industrial development: An East Asian model*. New York: Macmillan.

Table 1. Sub-clusters and ethnicity

	Total	Nairobi – Moshi road	Dodoma road – Oljoro road	City center	Industrial area	Sokoine road – Arusha Tech	Nationwide *
Chagga	99(41%)	37(48%)	15(33%)	21(48%)	11(29%)	12(40%)	1.80%
Pare	29(12%)	4(5%)	9(20%)	3(7%)	6(16%)	7(23%)	1.50%
Sambaa	15(6%)	3(4%)	2(4%)	2(5%)	6(16%)	2(7%)	1.90%
Meru	10(4%)	6(8%)	0	1(2%)	0	3(10%)	0.40%
Sukuma	8(3%)	2(3%)	4(9%)	1(2%)	0	1(3%)	14.70%
Arusha	7(3%)	4(5%)	1(2%)	1(2%)	0	1(3%)	N/A
Maasai	7(3%)	5(7%)	0	2(5%)	0	0	0.80%
Nyaturu	7(3%)	2(3%)	3(7%)	1(2%)	1(3%)	0	2.00%
Other	55(24%)	14(17%)	11(25%)	12(27%)	14(36%)	4(14%)	76.90%
Total	234	77	45	44	38	30	100%

*Source of nationwide percentage: Joshua Project (2009)

Table 2. Concentration of workshops and new entrants (by sub-cluster)

	Total	Nairobi – Moshi road	Dodoma road – Oljoro road	City center	Industrial area	Sokoine road – Arusha Tech
Area (km2)	17.13	5.51	4.90	2.14	3.77	0.81
No. of workshops (04)	105(100%)	34(32%)	19(18%)	21(20%)	23(22%)	8(8%)
No. of workshops (07)	234(100%)	77(33%)	45(19%)	44(19%)	38(16%)	30(13%)
Workshop density (04)	6.13	6.17	3.87	9.81	6.11	9.91
Workshop density (07)	13.66	13.96	9.18	20.56	10.09	37.18
No. of workshops established between 2005 - 2007	129	43(33%)	26(20%)	23(18%)	15(12%)	22(17%)

Table 3. Characteristics of the sub-clusters

Sub-cluster	N. of Obs.	**Visitors (persons/day)**	**Processing time (min)**	**Timber access driving time (min)**	**Scale of production (billion Tsh)**
			2007		
Industrial area	38	5.66	101	21	292
Nairobi-Moshi road	77	3.42	63	20	437
Sokoine road	30	4.93	116	10	373
Dodoma road	45	6.00	282	11	188
City Center	44	3.23	135	7	122
Total	234		134	17	298
			2004		
Industrial area	23	5.61	171	33	57
Nairobi-Moshi road	34	4.11	182	27	182
Sokoine road	8	6.50	138	10	73
Dodoma road	19	7.53	163	10	60
City Center	21	3.75	233	7	44
Total	105		183	21	97
			Difference		
Industrial area	15	0.05	-70	-12.2	235
Nairobi-Moshi road	43	-0.70	-119**	-6.7	255
Sokoine road	22	-1.57	-23	0.2	301
Dodoma road	26	-1.53	119	0.8	128
City Center	23	-0.52	-98	0.0	78

Table 4. Determinants of location choice

Specifications	(1)	(2)	(3)	(4)
Concentration of the workshops (04)		-0.072	-0.047	-0.11
		(1.88)	(1.08)	(1.87)
Percentage of other producers having the same ethnicity in the sub-cluster (04)		7.132**	7.294**	7.525**
		(3.22)	(3.14)	(3.00)
Scale of production (04)	0.749**		0.562***	0.529*
	(3.04)		(3.29)	(2.03)
Number of visitors (04)	-0.149			-0.641
	(0.44)			(1.55)
Access to timber (driving time 0	-0.296			-0.272
	(1.47)			(1.09)
AIC	407.164	406.582	397.934	398.748
BIC	420.572	415.52	411.342	421.095
N of Obs	645	645	645	645

The standard error is adjusted to take account of the clustering of the workshops
Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

We also incorporate the variable land rent in specification (4), but the coefficient is omitted due to collinearity between the variable of the Scale of production.

Table 5. Summary of the inputs and outputs used in the calculation of the DEA

Unit:Tsh

Sub-cluster	Outputs	Raw materials	Labor	Capital
Industrial area	7,694,737	4,743,232	2,513,486	1,193,632
	(38)	(37)	(37)	(37)
Nairobi – Moshi road	5,754,329	5,594,831	1,876,427	755,253
	(76)	(74)	(75)	(75)
Sokoine road - Arusha Tec	12,400,000	6,680,913	1,493,433	1,483,320
	(30)	(30)	(30)	(30)
Dodoma road - Oljoro road	4,173,333	8,342,489	3,190,444	1,332,589
	(45)	(45)	(45)	(45)
City Centre	2,774,727	3,982,432	1,167,977	522,844
	(44)	(44)	(44)	(44)
Total	6,060,828	5,828,624	2,049,762	988,224
	(233)	(230)	(231)	(231)

Table 6. DEA by sub-cluster

	CE	TE	AE
Industrial area	0.143	0.195	0.77
Nairobi-Moshiroad	0.116	0.179	0.681
Sokoine road	0.08	0.141	0.627
Dodoma road	0.093	0.121	0.701
City Center	0.094	0.133	0.67

Table 7. Determinants of performance

	CE	TE	AE	Dryness
Owner's age	0.002	-0.013	0.002	0.025
	(0.33)	(0.86)	(0.14)	(0.99)
Owner's age squared	0	0	0	0
	(0.23)	(1.04)	(0.61)	(0.94)
Former furniture seller	-0.070*	-0.081	-0.069	0.183*
	(2.04)	(1.36)	(1.18)	(2.43)
Spin-off producer	-0.049**	-0.073*	0.089	0.08
	(2.63)	(2.03)	(1.45)	(1.50)
Education	0.024	0.078*	-0.114*	0.106**
	(1.09)	(2.19)	(2.34)	(2.89)
Years of operation	0	-0.002	0.003	-0.007
	(0.19)	(0.91)	(0.72)	(0.81)
Waiting time for wood processing	-0.004**	-0.003	-0.013**	-0.024
	(2.95)	(1.73)	(2.85)	(1.89)
Workshop density (04)	-0.003	0.004	-0.021	-0.004
	(0.64)	(0.67)	(1.96)	(0.24)
Percentage of other producers having the same ethnicity in the sub-cluster (04)	-0.029	-0.008	0.029	0.099
	(0.90)	(0.19)	(0.36)	(0.80)
Scale of production (04)	-0.036	-0.027	-0.097*	0.033
	(1.39)	(0.80)	(2.38)	(0.46)
Access to timber (driving time to supplies 04)	0.03	0.055	0.035	-0.064
	(1.11)	(1.66)	(0.91)	(0.75)
Sub-cluster dummies	Yes	Yes	Yes	Yes
_cons	0.66	0.643	2.584***	0.866
	(1.52)	(0.97)	(3.53)	(0.69)
Adj_R2	0.00635	0.0644	0.0807	0.031
aic	-292.3	-189.8	22.74	243.3
bic	-248.5	-145.9	66.56	287.4
N	215	215	215	220

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Figure 1. Increase in the number of furniture workshops in Arusha (by sub-cluster)

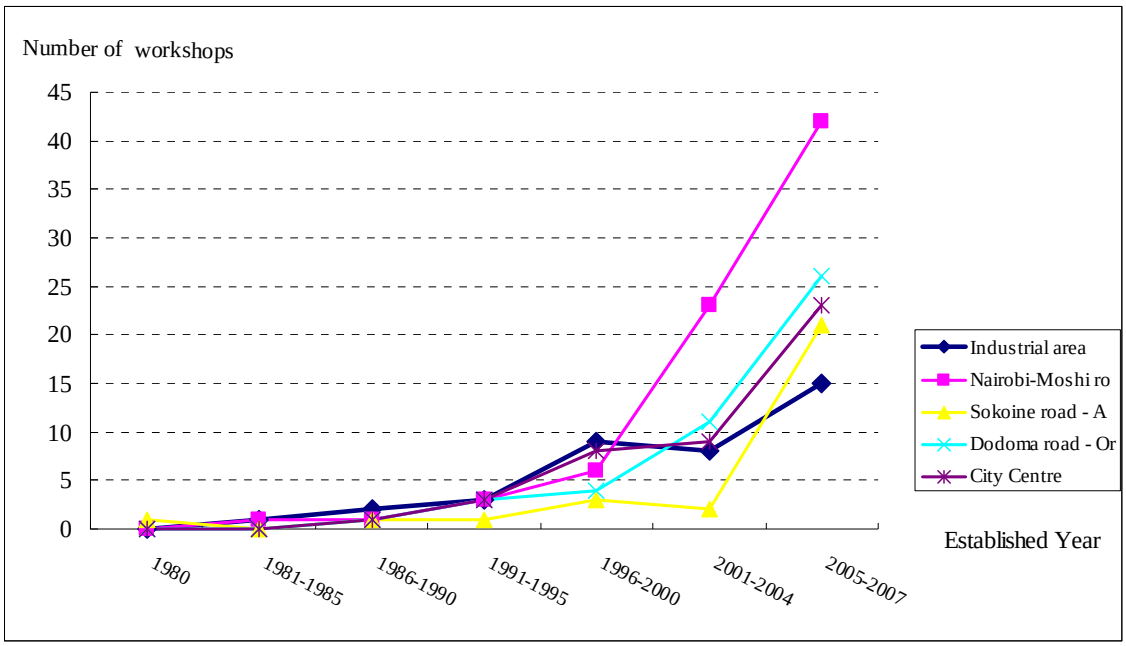
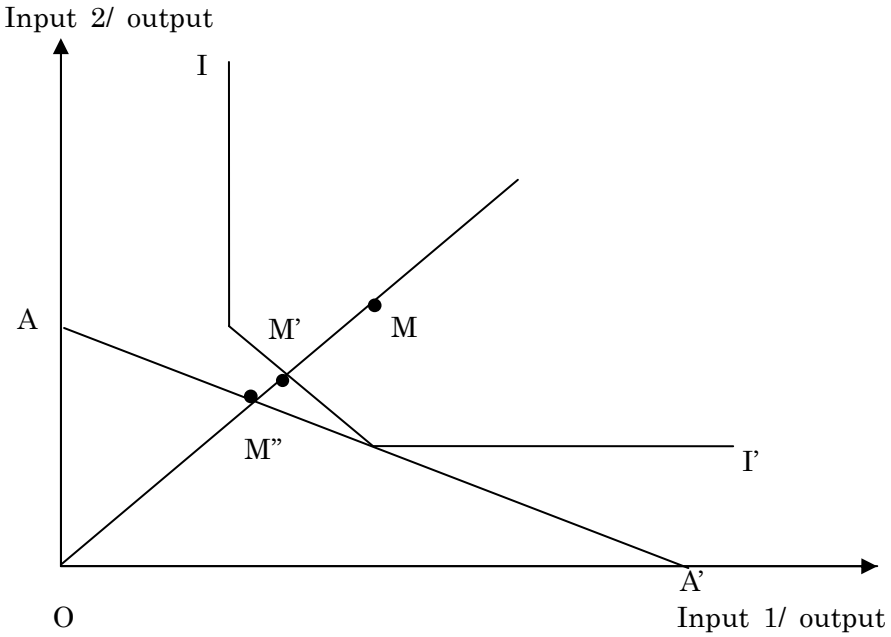
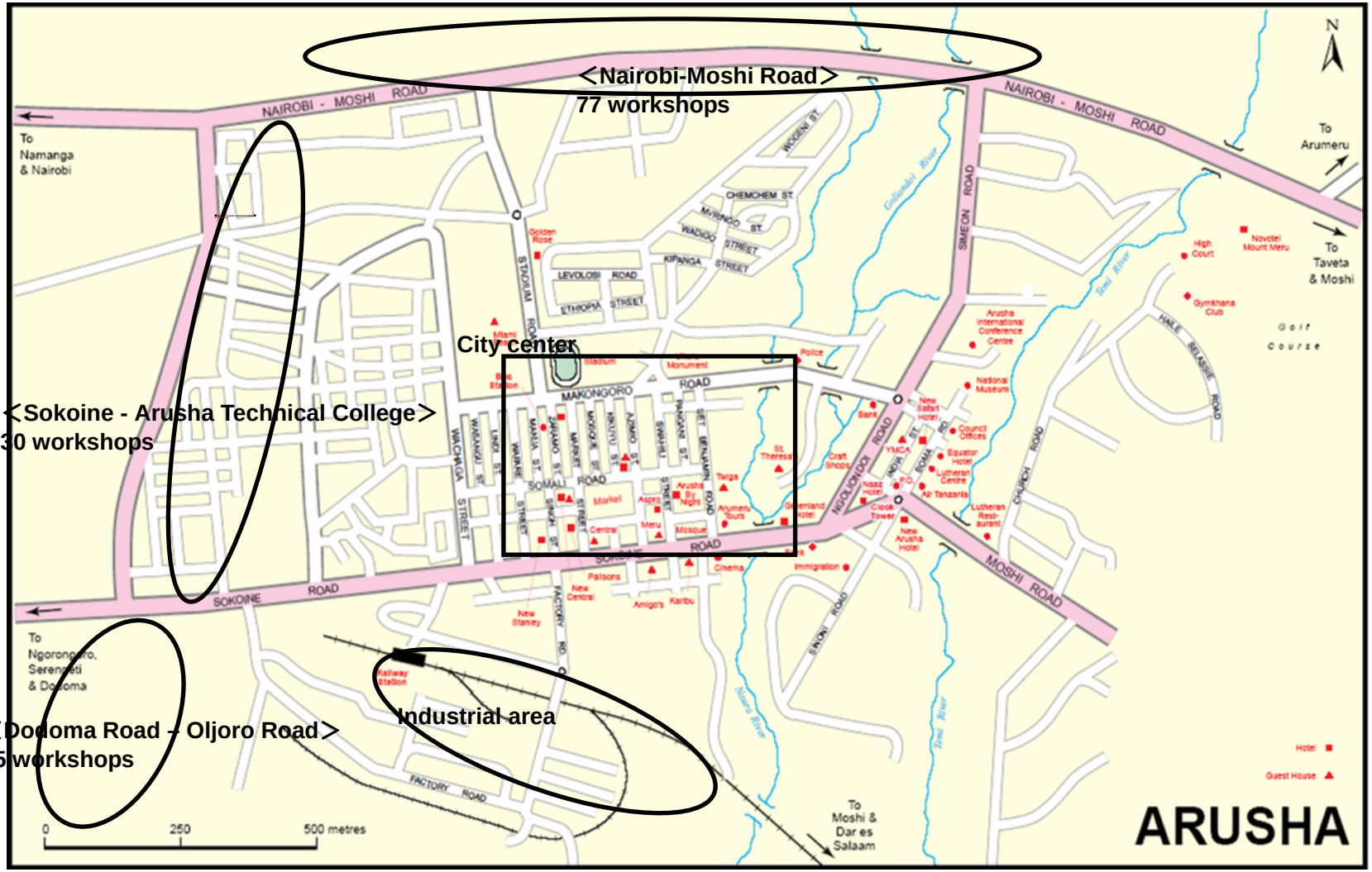


Figure 2. Graphical description of DEA



Appendix 1. Map of furniture sub-clusters in the Arusha municipality



Appendix 2. DEA by cluster

(1) DEA of the Industrial area

Ticker	Area	CE	TE	AE
1002	Industrial area	0.01	0.01	0.999
1003	Industrial area	0.011	0.015	0.741
1004	Industrial area	0.031	0.078	0.392
1005	Industrial area	0.09	0.111	0.809
1006	Industrial area	0.004	0.01	0.359
1007	Industrial area	0.212	0.229	0.927
1008	Industrial area	0.103	0.159	0.648
1009	Industrial area	0.145	0.148	0.981
1010	Industrial area	0.097	0.101	0.962
1011	Industrial area	0.04	0.046	0.868
1012	Industrial area	0.064	0.07	0.912
1013	Industrial area	0.02	0.021	0.962
1014	Industrial area	0.015	0.017	0.895
1015	Industrial area	0.096	0.101	0.95
1016	Industrial area	0.015	0.039	0.372
1017	Industrial area	0.074	0.094	0.789
1018	Industrial area	0.188	0.295	0.636
1019	Industrial area	0.282	1	0.282
1020	Industrial area	0.138	0.154	0.9
1021	Industrial area	0.26	0.488	0.534
1022	Industrial area	0.046	0.241	0.191
1023	Industrial area	0.585	0.618	0.948
1024	Industrial area	1	1	1
1025	Industrial area	0.117	0.163	0.721
1026	Industrial area	0.281	0.421	0.667
1027	Industrial area	0.146	0.149	0.979
1028	Industrial area	0.041	0.057	0.714
1029	Industrial area	0.373	0.386	0.965
1030	Industrial area	0.105	0.125	0.839
1031	Industrial area	0.065	0.096	0.678
1033	Industrial area	0.036	0.038	0.95
1036	Industrial area	0.11	0.126	0.872
1037	Industrial area	0.069	0.105	0.656
1038	Industrial area	0.179	0.184	0.976
1039	Industrial area	0.008	0.009	0.895
1096	Industrial area	0.084	0.114	0.733

Appendix 2 (continued)

(2) DEA of the Nairobi-Moshi Road area (first half)

Ticker	Area	CE	TE	AE
2001	Nairobi-Moshi road	0.012	0.012	0.986
2002	Nairobi-Moshi road	0.5	0.741	0.675
2004	Nairobi-Moshi road	0.134	0.315	0.427
2005	Nairobi-Moshi road	0.14	0.38	0.367
2006	Nairobi-Moshi road	0.12	0.143	0.838
2007	Nairobi-Moshi road	0.202	0.227	0.889
2009	Nairobi-Moshi road	0.351	0.351	0.998
2010	Nairobi-Moshi road	0.032	0.042	0.761
2011	Nairobi-Moshi road	0.302	0.339	0.892
2012	Nairobi-Moshi road	0.024	0.045	0.549
2014	Nairobi-Moshi road	0.045	0.167	0.269
2016	Nairobi-Moshi road	0.193	0.196	0.984
2017	Nairobi-Moshi road	0.126	0.47	0.267
2018	Nairobi-Moshi road	0.105	0.194	0.542
2019	Nairobi-Moshi road	0.056	0.058	0.963
2020	Nairobi-Moshi road	0.023	0.029	0.787
2021	Nairobi-Moshi road	0.092	0.099	0.933
2022	Nairobi-Moshi road	0.099	0.288	0.342
2023	Nairobi-Moshi road	0.121	0.28	0.43
2024	Nairobi-Moshi road	0.009	0.009	0.987
2025	Nairobi-Moshi road	0.046	0.12	0.383
2026	Nairobi-Moshi road	0.097	0.197	0.491
2027	Nairobi-Moshi road	0.085	0.091	0.937
2028	Nairobi-Moshi road	0.217	0.373	0.581
2029	Nairobi-Moshi road	0.046	0.047	0.998
2030	Nairobi-Moshi road	0.302	0.389	0.776
2031	Nairobi-Moshi road	0.016	0.042	0.375
2032	Nairobi-Moshi road	0.268	0.282	0.952
2033	Nairobi-Moshi road	0.031	0.412	0.075
2034	Nairobi-Moshi road	0.102	0.119	0.861
2035	Nairobi-Moshi road	0.016	0.088	0.183
2036	Nairobi-Moshi road	0.029	0.029	0.993
2037	Nairobi-Moshi road	0.077	0.079	0.974
2038	Nairobi-Moshi road	0.073	0.191	0.38
2039	Nairobi-Moshi road	0.056	0.063	0.897
2040	Nairobi-Moshi road	0.03	0.041	0.741

Appendix 2 (Continued)

(2) DEA of the Nairobi-Moshi Road area (second half)

Ticker	Area	CE	TE	AE
2041	Nairobi-Moshi road	0.017	0.027	0.63
2042	Nairobi-Moshi road	0.013	0.015	0.908
2043	Nairobi-Moshi road	0.071	0.177	0.4
2044	Nairobi-Moshi road	0.051	0.083	0.615
2045	Nairobi-Moshi road	0.03	0.086	0.348
2046	Nairobi-Moshi road	0.279	0.369	0.754
2047	Nairobi-Moshi road	0.038	0.076	0.505
2048	Nairobi-Moshi road	0.119	0.215	0.551
2049	Nairobi-Moshi road	0.267	0.267	0.998
2050	Nairobi-Moshi road	0.074	0.077	0.965
2051	Nairobi-Moshi road	0.071	0.083	0.853
2052	Nairobi-Moshi road	0.108	0.109	0.99
2053	Nairobi-Moshi road	0.027	0.057	0.482
2054	Nairobi-Moshi road	0.096	0.226	0.424
2055	Nairobi-Moshi road	0.035	0.036	0.995
2056	Nairobi-Moshi road	0.161	0.316	0.51
2057	Nairobi-Moshi road	0.106	0.108	0.98
2058	Nairobi-Moshi road	0.032	0.043	0.747
2059	Nairobi-Moshi road	0.033	0.047	0.706
2060	Nairobi-Moshi road	0.038	0.135	0.283
2061	Nairobi-Moshi road	0.024	0.044	0.545
2062	Nairobi-Moshi road	0.109	0.273	0.4
2064	Nairobi-Moshi road	0.054	0.087	0.624
2065	Nairobi-Moshi road	0.034	0.042	0.816
2066	Nairobi-Moshi road	0.032	0.283	0.112
2067	Nairobi-Moshi road	0.138	0.545	0.253
2068	Nairobi-Moshi road	0.035	0.166	0.213
2069	Nairobi-Moshi road	0.29	0.403	0.719
2070	Nairobi-Moshi road	0.04	0.047	0.861
2071	Nairobi-Moshi road	0.114	0.129	0.89
2072	Nairobi-Moshi road	0.043	0.044	0.976
2073	Nairobi-Moshi road	0.049	0.103	0.476
2074	Nairobi-Moshi road	0.053	0.107	0.5
2075	Nairobi-Moshi road	0.03	0.041	0.733
2076	Nairobi-Moshi road	0.054	0.097	0.555
2077	Nairobi-Moshi road	0.185	1	0.185

Appendix 2 (Continued)

(3) DEA of the Sokoine Road area

Ticker	Area	CE	TE	AE
1032	Sokoine road	0.013	0.038	0.349
1035	Sokoine road	0.121	0.176	0.686
1041	Sokoine road	0.009	0.144	0.061
1042	Sokoine road	0.157	0.189	0.829
1043	Sokoine road	0.193	0.214	0.905
1044	Sokoine road	0.046	0.139	0.333
1045	Sokoine road	0.043	0.044	0.972
1046	Sokoine road	0.036	0.037	0.965
1047	Sokoine road	0.039	0.069	0.565
1048	Sokoine road	0.108	0.136	0.792
1049	Sokoine road	0.007	0.044	0.149
1050	Sokoine road	0.048	0.055	0.869
1055	Sokoine road	0.072	0.092	0.782
3001	Sokoine road	0.18	0.281	0.641
3002	Sokoine road	0.372	0.8	0.465
3003	Sokoine road	0.079	0.08	0.983
3004	Sokoine road	0.056	0.1	0.561
3005	Sokoine road	0.055	0.133	0.417
3006	Sokoine road	0.09	0.222	0.404
3007	Sokoine road	0.167	0.366	0.457
3008	Sokoine road	0.026	0.043	0.603
3009	Sokoine road	0.055	0.135	0.406
3010	Sokoine road	0.089	0.159	0.556
3011	Sokoine road	0.097	0.199	0.486
3012	Sokoine road	0.028	0.04	0.706
3013	Sokoine road	0.017	0.017	0.975
3014	Sokoine road	0.066	0.071	0.929
3015	Sokoine road	0.03	0.035	0.87
5031	Sokoine road	0.016	0.033	0.472

Appendix 2 (Continued)

(4) DEA of the Dodoma Road area

Ticker	Area	CE	TE	AE
1051	Dodoma road	0.002	0.009	0.194
1052	Dodoma road	0.034	0.036	0.966
1053	Dodoma road	0.035	0.13	0.27
1054	Dodoma road	0.073	0.11	0.663
1056	Dodoma road	0.186	0.202	0.921
1057	Dodoma road	0.034	0.039	0.869
1058	Dodoma road	0.023	0.04	0.567
1059	Dodoma road	0.206	0.283	0.729
1060	Dodoma road	0.263	0.285	0.925
1061	Dodoma road	0.085	0.085	0.991
1062	Dodoma road	0.236	0.24	0.985
1063	Dodoma road	0.016	0.046	0.359
1064	Dodoma road	0.012	0.027	0.437
1065	Dodoma road	0.284	0.297	0.958
1066	Dodoma road	0.057	0.082	0.701
1067	Dodoma road	0.039	0.043	0.905
1068	Dodoma road	0.065	0.065	0.989
1069	Dodoma road	0.007	0.022	0.309
1070	Dodoma road	0.031	0.036	0.849
1071	Dodoma road	0.128	0.13	0.982
1072	Dodoma road	0.121	0.126	0.965
1073	Dodoma road	0.018	0.123	0.15
1074	Dodoma road	0.541	0.567	0.954
1075	Dodoma road	0.029	0.029	0.99
1076	Dodoma road	0.091	0.102	0.891
1077	Dodoma road	0.027	0.051	0.527
1078	Dodoma road	0.113	0.117	0.96
1079	Dodoma road	0.052	0.052	0.998
1080	Dodoma road	0.015	0.034	0.458
1081	Dodoma road	0.043	0.043	0.99
1082	Dodoma road	0.119	0.121	0.982
1083	Dodoma road	0.039	0.047	0.832
1084	Dodoma road	0.013	0.056	0.235
1085	Dodoma road	0.571	0.604	0.945
1086	Dodoma road	0.083	0.084	0.989
1087	Dodoma road	0.013	0.071	0.179
1088	Dodoma road	0.082	0.083	0.991
1089	Dodoma road	0.123	0.167	0.734
1090	Dodoma road	0.32	0.333	0.959
1091	Dodoma road	0.084	0.086	0.98
1092	Dodoma road	0.065	0.113	0.572
1093	Dodoma road	0.039	0.098	0.395
1094	Dodoma road	0.003	0.021	0.125
1095	Dodoma road	0.027	0.044	0.626
1097	Dodoma road	0.013	0.071	0.179

Appendix 2 (Continued)

(5) DEA of the City Centre

Ticker	Area	CE	TE	AE
5001	City Centre	0.098	0.115	0.854
5002	City Centre	0.133	0.136	0.977
5003	City Centre	0.091	0.186	0.49
5004	City Centre	0.068	0.184	0.371
5005	City Centre	0.023	0.07	0.331
5006	City Centre	0.085	0.198	0.431
5007	City Centre	0.424	0.442	0.959
5008	City Centre	0.017	0.026	0.663
5009	City Centre	0.011	0.028	0.383
5010	City Centre	0.048	0.107	0.449
5011	City Centre	0.018	0.03	0.614
5012	City Centre	0.042	0.043	0.965
5013	City Centre	0.067	0.069	0.972
5014	City Centre	0.057	0.141	0.403
5015	City Centre	0.147	0.184	0.799
5016	City Centre	0.016	0.066	0.237
5017	City Centre	0.206	0.213	0.966
5018	City Centre	0.081	0.109	0.739
5019	City Centre	0.176	0.272	0.647
5020	City Centre	0.065	0.098	0.661
5021	City Centre	0.012	0.041	0.291
5022	City Centre	0.042	0.12	0.353
5023	City Centre	0.015	0.022	0.661
5024	City Centre	0.015	0.02	0.767
5025	City Centre	0.083	0.158	0.524
5026	City Centre	0.18	0.184	0.975
5027	City Centre	0.049	0.088	0.557
5028	City Centre	0.046	0.064	0.726
5029	City Centre	0.128	0.207	0.621
5030	City Centre	0.083	0.12	0.687
5032	City Centre	0.092	0.126	0.734
5033	City Centre	0.138	0.2	0.688
5034	City Centre	0.132	0.303	0.437
5035	City Centre	0.042	0.058	0.721
5037	City Centre	0.02	0.031	0.646
5038	City Centre	0.377	0.394	0.959
5039	City Centre	0.076	0.086	0.881
5041	City Centre	0.046	0.059	0.78
5042	City Centre	0.067	0.103	0.656
5044	City Centre	0.112	0.118	0.953
5045	City Centre	0.05	0.105	0.476
5046	City Centre	0.108	0.157	0.69
5047	City Centre	0.023	0.084	0.275
5048	City Centre	0.179	0.266	0.675

Abstract (in Japanese)

要約

本稿では、タンザニアのアルーシャ市内で自然発生的に形成された５つの家具産業の集積から得られたデータを用い、木製家具の作業所の立地選択が企業の業績にどのようなインパクトを与えるかを分析する。2007 年に、特徴が異なる 5 つの集積地に立地した 234 の作業所の全数調査が行われた。立地選択の検証の結果、家具業者は同じ民族の同業者が集まった集積地を選択する傾向があることが判明した。他の国と同様、アフリカの起業家は、技術移転の効果を期待し、より規模の大きい企業が集積する場所に起業する傾向があることも判明した。この結果は、集積経済学の文献と一致する。しかしながら、Data Envelop Analysis (DEA)の手法で計測された業績、及び木製品の含水率で計算した製品の品質に関する分析では、民族のネットワークが作業所の業績と製品の品質に貢献していないことが示された。 対照的に、より多くの木材加工所が存在する集積地に位置する家具作業所は、そうではない集積地に位置する作業所よりも業績が優れていた。これは、川上産業を完備することで、産業の開発が促進されることを示唆している。