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Value added of Cluster Membership for Micro Enterprises of the Handloom Sector in Ethiopia

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Value Added of Cluster Membership for Micro Enterprises of the Handloom Sector in Ethiopia

Summary

By contrasting the performance of clustered micro enterprises with that of dispersed ones in the handloom sector in Ethiopia, this study shows that clustering significantly increases profit. To correct for selection bias, we match clustered and dispersed micro enterprises that share similar observable characteristics except for being clustered both in urban and rural areas. Results show that clustering is more profitable in urban than rural areas. It is also found that regional specific factors determining clustering of micro enterprises are different in urban and rural areas, highlighting the need to focus on local circumstances when formulating policies to promote clusters.

Keywords: cluster, micro enterprises, propensity score matching, handloom, Africa, Ethiopia.

1. INTRODUCTION

The question of how to promote the growth potential of micro enterprises in developing countries has dominated the center of policy debates since the 1960s. Micro enterprises are recognized to have potentials to reach out small and specialized markets and are flexible in allocating resources to changing opportunities. They also generate income and employment in labor intensive sectors engaging the poorest segment of the society particularly women and unskilled labor (UNIDO, 2004). Yet, micro enterprises encounter various constraints and transaction costs that affect their business environment and undermine their development (Dennis, 1982; Boomgard et al., 1992). They are often characterized by low productivity, poor information access, limited technical know-how and lack capital and market access, mostly serving local markets. In recent years, however, it has been recognized that industrial clusters can reduce much of the transaction costs faced by micro enterprises and help to overcome their growth obstacles.

The concentration of economic activities within a certain sector producing similar and closely related goods may result in cost reducing economies of scale, location economies, to micro enterprises in the cluster. These location economies help to increase the competitiveness of micro enterprises in a wider market by promoting

‘collective efficiency’ through knowledge diffusion, specialization and social cooperation (Schmitz, 1995; Schmitz and Nadiv, 1999). On the other hand, there could also be increased costs resulting from fierce competition among micro enterprises and congestion that can offset the potential benefits of clustering (Lall et al., 2003).

Industrial clusters in developing courtiers are particularly common in traditional and labor intensive micro enterprises in rural and poor urban areas. This has attracted the interest of policy makers and development agencies like World Bank, UNIDO and ILO because of the direct impact such kind of clusters will have on poverty. Owing to the existing policy enthusiasm on promoting clusters, it is therefore important to investigate if clustering actually results in significant economic gains to micro enterprises that could positively impact poverty.

Previous studies are unable to address the above issue fully, because of lack of income data and their orientation towards case studies often lacking comparative analysis. The few comparative analyses available, e.g. Visser (1999) and Weijland (1999), do not take in to consideration the issue of selection bias. Is good performance explained by factors determining location economies or do micro enterprises with certain characteristics look out for profitable and productive locations? Failure to address this question may result in over estimating the impact of clustering on micro enterprises. It is also important for policies aiming at promoting clustering to know the extra income that can be generated by isolated micro enterprises if they were to cluster. Furthermore, since the development opportunities and constraints differ in urban and rural areas, it is important to distinguish factors that determine clustering of micro enterprises in these two regions in order to have appropriate tailor-made policies.

The purpose of this study is to investigate clustering advantages by contrasting the performance of clustered micro enterprises, in terms of profit, with that of control groups of dispersed ones in the handloom sector in Ethiopia both in urban and rural areas. To take into account the problem of selection bias, we match clustered micro enterprises with that of dispersed ones that have the same observable characteristics except for being clustered by using a non-parametric statistical method known as propensity score matching (Heckman et al., 1997). To the best of our knowledge this has not been done before. The study also aims to identify factors determining clustering of micro enterprises in urban and rural areas.

The remainder of the paper is organized as follows. In section two, the handloom sector in Ethiopia will be discussed briefly. Section three presents the methodology and section four provides discussion of the data used. Section five and six present the empirical model and the results respectively. Section seven provides a general discussion and conclusions.

2. THE HANDLOOM SECTOR IN ETHIOPIA

In Ethiopia, per capita rural landholdings have declined from 0.5 ha in the 1960s to 0.11 ha in 1999 (MoFED, 2006), indicating increasing landlessness and declining absorptive capacity of the agricultural sector for the increased labor force. The growth in labor force is beyond what large enterprises and the public sector can accommodate. A substantial number of new job seekers in Ethiopia have therefore turned to micro enterprises as the main source of livelihood. For this, the number of people earning their livelihood from micro enterprises and small scale manufacturing industries is eight times larger than those engaged in medium and large scale industrial establishments (CSAE, 2002).

The handloom sector being one of the of the most important segments of micro enterprises in Ethiopia supports the lives of more than 227,000 people with 55% of them existing in rural areas and 48.5% are women (CSAE, 2003). Child labor is a common phenomenon in the sector as well with the number of persons engaged with less than 18 years of age being 13% (ibid).

In addition to its income and employment creation, the sector has strategic importance in the economic development of the country through its strong linkage with the agricultural sector and a growing demand for its products both domestically and internationally (Demesse et al., 2005). In the handloom sector, micro enterprises are cottage industries where most of the labor and capital are provided by the household owning the firm.

Micro enterprises operating in the handloom sector of Ethiopia are found in naturally emerged clusters and dispersed from each other in different regions of the country both in rural and urban areas. For example in the capital city Addis Ababa, of the estimated 60,000 micro enterprises in the sector, 20,000 of them are found clustered in a district called *Gullele* in the northern part of the city (ILO, 2005). This study uses 4334 micro enterprises (2147 clustered and 2187 dispersed) in four different regions; Tigray, Amhara, Southern Nations Nationalities and People (SNNP), and Addis Ababa.

3. PROPENSITY SCORE MATCHING

In order to capture the impact of clustering on profitability of micro enterprises, the study uses propensity score matching (PSM). The main pillars of PSM are individuals (micro enterprises), the treatment (clustering) and potential outcome (profit). The idea is to match those micro enterprises that receive a treatment (clustered micro enterprises) with that of a control group (dispersed micro enterprises) sharing similar observable characteristics. Then the mean effect of treatment (clustering) is calculated as the average difference in profitability between the treated and non treated control group.

Let $D_j \varepsilon \{1,0\}$, be an indicator of whether micro enterprise j is clustered or dispersed, that is whether micro enterprise j have received a treatment or not. The potential outcome of clustering, profit, is defined as, $\pi_j(D_j)$ for each micro enterprise j, where $j = 1,...,N$ denoting the total population. The effect of clustering on individual micro enterprise j can then be written as;

$$T_j = \pi_{j(1)} - \pi_{j(0)} . \tag{1}$$

With this specification, however, one can not observe the counterfactual, that is the profitability of enterprise j had it not been located within a cluster. To deal with this problem, other micro enterprises that share similar observable characteristics, but are not clustered, will be identified and the average treatment effect, instead of individual treatment effect, will be computed. The above equation will then become;

$$T_{ATT} = E(T|D=1) = E[\pi_{(1)}|D=1] - E[\pi_{(0)}|D=1] \tag{2}$$

where, T_{ATT} is the average treatment effect on the treated.

An important assumption of this method is the conditional independence assumption (CIA) which states that, the set of observable characteristics should determine both the probability (propensity score) of receiving a treatment (being clustered) and the outcome of interest (profit of micro enterprises); that is $(\pi_0, \pi_1) \perp D / \mathbf{v}$, denoting the statistical independence of (π_0, π_1) conditional on observable characteristics, $\mathbf{v}$. This is a non-causality condition that excludes the dependence between the potential outcome and the probability of receiving a treatment (Heckman et al., 1997).

If all the variables influencing both the probability of being clustered and profitability of micro enterprises are not incorporated, then CIA is violated since the impact of clustering will be accounted by information that is not included in the estimation of the propensity score (Smith and Todd, 2005). To prevent the violation of CIA, explanatory variables that are supported by economic theory are included in the probit model that is used to generate predicted probabilities (propensity scores) which will then be used to match micro enterprises (see section 5).

Given that the CIA holds, the PSM estimate for ATT can be written as;

$$T_{ATT}^{PSM} = E_{P(v)|D=1}\left\{E\left[\pi_{(1)}\middle|D=1, P(v)\right] - E\left[\pi_{(0)}\middle|D=0, P(v)\right]\right\} \quad (3)$$

where $P(v)$ is the probability of receiving a treatment (being clustered) based on observable characteristics, v.

Once the probit model is estimated to generate the propensity score, a dispersed micro enterprise that is 'closest' in terms of propensity score has to be selected as a match. This is done using the Kernel matching method that associates the outcome π of a clustered micro enterprise j with the matched outcome that is given by a kernel-weighted average of all the dispersed micro enterprises. Since the weighted average of all micro enterprises in the dispersed group are used to construct the counterfactual outcome, kernel matching has an advantage of lower variance because more information is used (Heckman et al., 1998). The weight given to dispersed micro enterprise i is in proportion to the closeness between i and the clustered micro enterprise j.

In order to eliminate outliers that have very high and very low propensity scores, the matching is restricted on the area of common support in the sample which is defined between the lowest propensity score of the clustered and the highest propensity score of the dispersed group. To be effective, matching should balance observable explanatory variables across clustered and dispersed micro enterprises. For this a balancing test is performed after the match. This test is primarily concerned with the extent to which the difference in the observable characteristics between the clustered and dispersed groups have been eliminated so that any difference in outcome variable (profit) between the two groups can be inferred as coming from the treatment i.e. clustering.

4. DATA

4.1 Data sets

Enterprise level data from the 2002/03 survey on Cottage/Handicraft Manufacturing Industry, conducted by the Central Statistical Authority of Ethiopia (CSAE), is used in this study. In the study a total of 4336 micro enterprises are used from 120 districts in four different regions of Tigray, Amhara, SNNP and Addis Ababa. 1945 (45%) micro enterprises are from urban areas and the rest 2391 (55%) are from rural areas. In this data set micro enterprise specific variables like gender, age, experience and schooling of the owner operator are incorporated. The enterprise level data are supplemented by additional location specific variables from 2002/03 Welfare Monitoring Survey conducted by CSAE. It contains information regarding accessibility of markets, transport infrastructure (an all-weather road) and credit (micro finance institution) at each district level. Information from the 2002/03 survey on Large and Medium Scale Manufacturing Establishments conducted by CSAE is also used. This survey incorporates information about large manufacturing establishments of various industries located in different zones (a higher geographic unit next to district).

4.2 Location quotient

Since the concept of 'cluster' and 'dispersion' is prone to subjective judgment, several standard global indices have been developed to measure spatial concentration of activities. The location quotient (LQ) is one of the commonly utilized concentration indices (O'Donoghue and Gleave, 2004). It quantifies how "concentrated" a sector is in a certain location compared to a larger geographic area such as a nation, region or sub region, showing the proportion of specialization of a certain sector in a given location.

$$LQ_I = (e_I / e) / (E_I / E) \qquad (4)$$

where LQ_I the location quotient of industry *I* in the local region, e_I employment of industry *I* in the local region, e total manufacturing employment in the local region, E_I reference area employment in industry *I*, *E* total reference area manufacturing employment. Here total manufacturing employment includes employment in micro, medium and large scale manufacturing industries.

The location quotient is based upon calculating the ratio between employment of a certain sector to some reference unit. It is computed at the finest spatial unit possible,

the district, both in urban and rural areas taking zone which is a higher geographic region as a reference point. In order to calculate the LQ, data from the survey on Cottage/ Handicraft Manufacturing Industry (2002/03) together with data from Large and Medium Scale Manufacturing Establishments survey (2002/03) both collected by CSAE are used. Those districts with a LQ of greater than one are selected as having clustered micro enterprises and those with LQ of less than one are selected as having dispersed micro enterprises. This resulted in 2187 (50.44%) clustered and 2149 (49.56%) dispersed micro enterprises.

5. EMPIRICAL MODEL

Profit[1] in micro enterprises is determined, among other things, by input and output prices and transaction costs the producer is facing. Prices and transaction costs, e.g. 'search and reach' costs of input suppliers and output buyers are further affected by external economies of scale (Krugman, 1991). These economies can originate from co-locating near to other producers in the same industry (clustering) and also from regional factors outside clusters such as proximity to other industries as well as access to markets, credit and transport infrastructure. Regional factors provide advantages that are available to all producers regardless of industry affiliation through benefits that emanate from overall population and wealth of the location. In addition to external economies of scale, prices and transaction costs are also household dependent because micro enterprises can differ in terms of experience, schooling, etc. of the owner operator that can affect his/her ability to process information about markets and manage the production process. Hence profit is a function of micro enterprise specific, cluster specific and regional specific factors. These factors can also determine the likelihood that a micro enterprises will cluster in a certain location. In order to capture the true effect of clustering, enterprise and regional specific factors that can affect the profitability of micro enterprises apart from clustering should be controlled for.

Following the above argument, the explanatory variables in the probit regression that is used to generate propensity scores are divided in enterprises specific and regional specific factors.

Enterprises specific factors

As variables describing the characteristics of micro enterprises we take gender, age, schooling and experience. Gender is indicated by a dummy (1 when male, 0 when female). It is expected that gender matters as in urban areas male are more active in the handloom sector while in rural areas females are more active (CSAE, 2003). Schooling is measured in years that range from 0 indicating no formal education

until 13 indicating higher education beyond high school. The average year of schooling of micro enterprise operators ranges from two to three years in urban and rural areas respectively (Table I. Appendix I). Due to the low level of average education, we would expect an increase in schooling to have a positive effect on the probability of being clustered. Age and experience is captured by how old the owner operator is and for how many years he/she has been in the business respectively. We expect the effect of age and experience to be non-linear, therefore we include in the probit regression the squared terms in addition to the level.

Regional specific factors

These are further classified in to concentration of industrial activities and access to various facilities outside clusters.

Concentration

We include three variables describing industry concentration. First, concentration of micro enterprises from other industries other than the handloom sector in the same district. Second, concentration of big textile factories in the same zone (group of districts). Third, concentration of big manufacturing factories from other industries in the same zone. All three are measured using location quotients based on employment.

These three variables are indicators of externalities that surrounding industrial activities have on the handloom sector (see Krugman, 1991; Fujita et al., 1999). For example, Fujita and Thisse (1996) and Lall et al., (2003) showed that producers benefit from the existence of big firms from other industries in nearby areas. These inter-industry benefits include information spillovers, technological externalities, availability of pool of skilled workers, and existence of common services such as research and training centers, government and regulatory institutions, banking services etc.

The concentration of big manufacturing industries in the same zone is expected to have a larger positive effect in urban areas than rural areas because most of the big manufacturing industries are located in urban areas. The concentration of big textile factories in the same zone is expected to have a positive effect both in rural and urban areas as there can be backward and forward linkages in terms of inputs sharing and information spillover with regards to design, markets and outputs between big producers and micro enterprises operating in the same industry. For micro enterprises that operate in industries other than the handloom sector and located in the same district, they can have a positive effect if their concentration promotes

multiple specialization which further triggers information spillover. On the other hand there can also be costs due to higher rents for housing and congestion, the latter often resulting in fierce competition for limited common resources.

Access to market, transport infrastructure and credit

Market access is calculated following the gravity model of accessibility (Evenett and Keller, 2002). According to this model, the degree of interconnection between two locations is directly related to the attractiveness of the locations which can be captured by employment opportunities and purchasing power of the population and is indirectly related to the physical separation between the two locations which can be captured by the presence or absence of a transportation link, physical distance or travel time. The general formulation of the gravity model following Hansen (1959) is:

$$A_m = \sum W_n f(d_{mn}) \tag{5}$$

where, A_m is the accessibility indicator at location m, W_n the weight that captures the attractiveness of location n, $f(d_{mn})$ is the "impediment" function that separates the two locations. The gravity model imposes a distance decay formulation on the impediment function that takes the inverse power (Lall et al., 2003).

In order to calculate market access, information from the Welfare monitoring survey, 2002/03 is used. Due to lack of data on purchasing power of the residents, population within each district is used in order to indicate the size of potential market. For a variable to be used in the impediment function, average travel time to the nearest market place is used. Following the general formulation of the gravity model, market access is then calculated as population in 100,000 divided by hours taken to reach the nearest market place in each district. In order to capture the impact of a distance decay, a square of the above specification is used. Economic activities are likely to concentrate around markets because of increasing returns to scale in production due to proximity to consumers and reduced transportation costs while delivering goods to the market (Krugman, 1991), so we expect market access to have a positive effect on the probability of being clustered.

In relation to market access, producers generally are more likely to concentrate in locations where the transport infrastructure enables to reach markets at low costs (Henderson et al., 2001; Krugman, 1998). And hence "activities are pulled *disproportionally*" towards locations with good infrastructure facilities (Henderson

et al., 2001). We measure access to transport infrastructure by the average travel time taken to reach the nearest all-weather road at each district level which is obtained from the Welfare Monitoring Survey 2002/03. Travel time to the nearest all-weather road instead of physical distance in kilometers is chosen to take into account for quality of the infrastructure. Although the availability of high quality infrastructure eases geographic barriers of interaction, enhancing technology diffusion and information spillover (Krugman,1991), it can have an opposite effect as there is more need to cluster when there is poor infrastructure. We would expect this effect to be more pronounced in rural areas due to their remoteness.

Credit is an important input in production. So, access to credit and especially credit that is targeted on micro enterprises matters. Therefore, having micro finance institutions in a district which is measured by average hours taken to reach the nearest micro finance institution is used, and hence the expected sign is negative. Data come from the 2002/03 Welfare Monitoring Survey.

Additional variables

As two additional variables we include a dummy indicating whether or not an enterprise is located in Addis Ababa and a dummy indicating whether or not an enterprise is located in a rural town. These two dummies are considered relevant since they provide information about all kind of externalities that cities provide.

6. RESULTS

6.1 Estimation results of the probit regression

The results of the probit regression for factors that determine clustering of micro enterprises are presented in Table 1. The predicted probabilities from the probit regression are used to generate matched micro enterprises. Because there is significant differences in many of the explanatory variables used including monthly profit between rural and urban areas (see Table I, Appendix I), the analysis has been performed for urban and rural areas separately.

Although some variables (e.g. schooling) increase the probability of being clustered both in rural and urban areas, we find some differences. While micro enterprises that are run by female, younger and more experienced operators are more likely to cluster in rural areas, this is not the case in urban areas. This confirms the fact that there are more female operators in rural than urban areas (CSAE, 2003). Loening et al., (2008) also found that young females are the main operators of non-farm enterprises in rural Ethiopia.

The concentration of micro enterprises in the same district but operating in other industries has a positive and significant effect in urban areas This implies that the positive externalities from information spillover and multiple specializations outweigh the negative effect of congestion and fierce competition. It is also positive in rural areas although not significant.

Similarly, concentration of big textile factories in the same zone has a positive and significant effect both in urban and rural areas. This points to the importance of backward and forward linkages in terms of inputs sharing and information spillover with regards to design, markets and outputs between big textile factories and micro enterprises operating in the same industry. Contrary to what we expected, micro enterprises have low probability of being clustered around big manufacturing industries in urban areas. This is probably because manufacturing industries in urban areas are located in suburbs which are defined by the government as industry or export zones.

Micro enterprises have high probability to cluster around markets in urban areas while they cluster further away from markets in rural areas. This is in line with the finding that micro enterprises in urban areas are more likely to cluster where there is good infrastructure as can be captured by time taken to reach to the nearest all-weather road while they cluster in remote areas where the all-weather road is not accessible in rural areas. This could indicate that there is more need to cluster in rural areas to compensate for remoteness. This finding also confirms Weijland (1999) who stated that industrial clusters are important in remote areas as they help to attract traders that link cottage industries with distant markets. On the other hand, micro enterprises in urban areas are clustered further away from a micro finance institution.

[Insert Table 1 here]

Micro enterprises in general are more likely to cluster in the capital city Addis Ababa than in other urban areas and cluster more in rural towns. This implies that micro enterprises are attracted by all kinds of positive externalities that the capital city and rural towns provide. A recent survey conducted by the International Food Policy Research Institute (IFPRI) on handloom producers in Ethiopia showed that micro enterprises in rural areas migrate to electrified towns searching for better infrastructure which will enable them to work longer hours (Ayele et al., 2009).

6.2 Effect of clustering on profit

Using the same explanatory variables as in the probit regression, a propensity score matching is done on micro enterprises both in urban and rural areas using Kernel matching. The results of the match are presented in Table 2 and 3.

[Insert Table 2 here]

[Insert Table 3 here]

The matching is done between micro enterprises from the treated (clustered) and non treated (dispersed) group that are on the common support (see Table 3). As shown in Table 2, in urban areas, matched clustered micro enterprises have a monthly average profit that is 89.29 birr (10.38 $)[4] higher than that of matched dispersed micro enterprises. This is equivalent to a 100.4% increase in average monthly profit for micro enterprises due to clustering[5]. Similarly, matched micro enterprises in rural areas have a monthly profit that is 13.52 birr (1.57 $) higher than that of matched dispersed micro enterprises which is equivalent to a 49.7% increase in average monthly profit due to clustering. It can also be observed from Table 2 that matched clustered micro enterprises in rural areas have a lower level of profit than their urban counterparts.

To check how the matching has performed in terms of eliminating differences in observable explanatory variables between the matched clustered and dispersed micro enterprises, balancing tests are undertaken. The ones used in this study are t-tests for equality of means on each explanatory variable between clustered and dispersed micro enterprises before and after the match (Sianesi, 2004) and a chi square test for the joint significance of variables used in the probit model before and after the match (Sianesi 2004; Smith and Todd, 2005).

For urban areas, all explanatory variables before the match between clustered and dispersed micro enterprises are not balanced, and the equality of means is rejected at the level of 5%, except for variables experience and distance to micro finance institution (Table II.1A in Appendix II). After the match, variables like experience and distance to micro finance institution are not balanced and the equality of means is rejected at 5% significance level. However, the chi square test after the match (Table II.1B in Appendix II) confirms that all the variables in the probit model are not jointly significant with prob>χ^2 = 0.23. This implies that there is no systematic

difference in the distribution of explanatory variables between the matched clustered and dispersed micro enterprises (Table II.1B in Appendix II).

For rural areas, most of the explanatory variables are not balanced before the match, especially for location specific variables. After the match, however, all the explanatory variables are balanced where equality of means for each variable is accepted at the level of 5%. The chi square test after the match also confirms that all the variables in the probit model are not jointly significant with prob>χ^2 = 0.13 (Table II.2B in Appendix II). Looking at the balancing test for rural areas further depicts that almost all matched clustered and dispersed micro enterprises are from locations outside rural towns, and this explains why the ATT for the matched micro enterprises is only 13.52 birr compared to the difference in profitability for the unmatched micro enterprises which is 19.54 birr.

The overall balancing tests imply that, the matching procedure has produced samples of micro enterprises that can reasonably be regarded as almost similar and any difference in profits between clustered and dispersed micro enterprises can be inferred as coming mainly from the effect of location economies of clustering.

6.3 Robustness Check

Since we used a LQ of 1 as a cut-off point to indicate whether a micro enterprise is clustered or not, we perform a robustness check to see if a higher cut-off point will also result in more profit for clustered micro enterprises. For this, we use the average LQ as a cut-off point with LQ of 1.30 and LQ of 1.47 for urban and rural areas respectively. The estimated ATT are given in Table 4 below .

[Insert Table 4 here]

[Insert Table 5 here]

As can be seen from Table 4, the extra profit earned by clustered micro enterprises increases as the cut-off point increases. Clustered micro enterprises earn 123.41 birr (14.35 $) and 14.57 birr(1.69 $) more than dispersed micro enterprises in urban and rural areas respectively. This is equivalent to a 147% and 49.8% increase in average

monthly profit due to clustering for urban and rural areas respectively. This implies that highly concentrated micro enterprises earn higher profits.

The balancing test for the match confirms that all the explanatory variables for urban and rural areas are balanced based on a t-test where the means of each variable is not significantly different from each other at the level of 1%.

7. DISCUSSION AND CONCLUSIONS

In this paper we examine clustering advantages by contrasting the performance of clustered micro enterprises in terms of profit, with that of dispersed ones in the handloom sector in Ethiopia both in urban and rural areas. To take into account for the problem of selection bias, we match clustered micro enterprises with dispersed ones that have the same observable characteristics except for being clustered. We classify these characteristics into enterprise specific and regional specific factors that determine the likelihood that a micro enterprises will cluster in a certain location.

Although some variables (e.g. schooling and concentration of big textile factories) increase the probability of being clustered both in rural and urban areas, there are also some differences. While micro enterprises that are run by female, younger and more experienced operators are more likely to cluster in rural areas, this is not the case in urban areas. Furthermore, micro enterprises in urban areas are more likely to cluster around markets and where there are good infrastructures while they cluster in remote rural areas further away from markets. The fact that enterprise and regional specific factors determine clustering of micro enterprises in urban and rural areas differently, therefore, calls a need to focus on the existing local circumstances when formulating policies that can promote clustering.

The Kernel matching reveals that there is a significant percentage increase in average monthly profit for micro enterprises due to clustering both in urban and rural areas. This depicts that location economies exist within clusters after controlling for selection bias. The robustness check further confirms that the more concentrated micro enterprises are the higher the percentage increase in profit. We also find that the percentage increase in profit from clustering is higher in urban than rural areas. This is because, working in the handloom sector in rural areas is often a part time job operated by women while agriculture is the main source of income. This can further be due to the poor infrastructure in rural areas that can increase input costs and limit

market access, the latter forcing micro enterprises to sell their products to visiting traders at low prices.

An interesting finding of this study is that there are micro enterprises that are not clustered but have the same observable characteristics with that of clustered micro enterprises. Whether or not to implement policies to cluster these micro enterprises, and if yes what kind of policies, depends on the explanation of why, given their similar characteristics, they are operating in isolation. One reason why micro enterprises are operating in isolation might be due to entry barriers to operate within clusters. There are many factors that can explain barriers to entry in which discussing these factors is beyond the scope of the current study. However, one important factor is that micro enterprises are cottage industries operating within the household which can not afford to rent separate working shops. Besides, the strong social norms and family ties might restrict their move to other locations. Hence it is difficult for them to abandon there current location and join clustered micro enterprises.

As part of its cluster development policies, the government of Ethiopia is building working shops around the cluster in the capital city Addis Ababa, that micro enterprises can rent at a low price or rent on credit. We believe that initiatives such as this could allow those micro enterprises working in isolation to easily join clusters.

A possible caveat of the study is that we only use Kernel matching, however, using other matching methods like nearest neighboring matching and radius matching provided similar results. Another caveat is that because of limited data availability we could not include more economic variables like prices in the model. Despite these caveats the analysis provides a flexible way to overcome selection bias in determining the factors behind clustering and its advantages in terms of generating extra profit.

NOTES

1. Profit is defined as the difference between value of production and variable input costs. Opportunity cost of family labor is not included because labor is assumed to be a fixed input in the short run.
2. Marginal effects are estimated at the sample mean except for the dummy variables.
3. Count R2 is calculated as the ratio of number of correct predictions to total sample. It shows what proportion of the observed dependent variable is correctly predicted by the model (Green, 2003)
4. The 2003 exchange rate was l $ = 8.6 birr.
5. The percentage increase in monthly average profit is calculated as the difference in average profit between matched clustered and dispersed micro enterprises divided by average profit of matched dispersed micro enterprises.
6. STATA software on psmatch2 is used which is developed by Edwin Leuven & Barbra Sianesi.
7. The standard error for the ATT is computed after bootstrapping 100 times.

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Table 1. Marginal effects[2] of the probability of being clustered resulting from the probit regressions (standard errors in parentheses).

	Urban	**Rural**
Male (dummy)	0.238 (0.03)***	-0.130 (0.07)**
Age	-0.004 (0.005)	-0.011 (0.006)*
Age squared	0.000 (0.000)	0.000 (0.000)
Schooling	0.016 (0.005)***	0.021 (0.011)*
Experience	-0.005 (0.004)	0.004 (0.003)**
Experience squared	0.000 (0.000)**	0.000 (0.000)
Concentration of micro enterprises in same district and different industry	0.222 (0.044)***	0.019 (0.017)
Concentration of big textile factories in the same zone	0.027 (0.009)***	0.073 (0.040)*
Concentration of big manufacturing factories in he same zone and different industry	-0.134 (0.016)***	-0.083 (0.056)
Market access	0.004 (0.001)***	-0.048 (0.022)**
Hours to the nearest micro finance institution	0.275 (0.026)***	-0.001 (0.004)
Hours to the nearest all-weather road	-0.430 (0.040)***	0.107 (0.047)**
Addis Ababa (dummy)	0.123 (0.048)***	---
Rural town (dummy)	---	0.722 (0.022)***
Number of observations	1945	2391
Prob > chi2	0.000	0.000
Count R2 (correctly classified)[3]	78.35%	73.61%

*significant at 10%, ** significant at 5%; *** significant at 1%

Table 2. Average monthly profit in birr for clustered and dispersed micro enterprises using Kernel matching[6]. The standard errors for the Average Treatment Effect of the Treated (ATT) are in parentheses[7].

		Clustered (treated)	Dispersed (non treated)	Difference
Urban	Unmatched	156.435	114.91	41.51
	Matched (ATT)	178.26	88.96	89.29
				(16.39)***
Rural	Unmatched	55.7118	36.17 11	19.5407
	Matched (ATT)	40.41	27.21	13.52
				(19.04)*

* significant at 10%, ** significant at 5%; *** significant at 1%.

Table 3. Number of micro enterprises with Kernel matching on the Common support

		Clustered (treated)	Dispersed (non treated)	Total
Urban	On support	183	931	1114
	Off support	831	0	831
	Total	1014	931	**1945**
Rural	On support	733	1256	1989
	Off support	402	0	402
	Total	1135	1256	**2391**

Table 4. Average monthly profit in birr for clustered and dispersed micro enterprises using Kernel matching. The standard errors for the Average Treatment Effect of the Treated (ATT) are in parentheses.

		Clustered (treated)	Dispersed (non treated)	Difference
Urban	Unmatched	166.81	113.41	53.40
	Matched (ATT)	207.34	83.93	123.41
				(16.01)***
Rural	Unmatched	53.36	35.93	17.43
	Matched (ATT)	43.81	29.24	14.57
				(38.54)*

* significant at 10%, ** significant at 5%; *** significant at 1%.

Table 5. Number of micro enterprises with Kernel matching on the Common support

		Clustered (treated)	Dispersed (non treated)	Total
Urban	On support	172	1102	1274
	Off support	671	0	671
	Total	843	1102	**1945**
Rural	On support	743	1086	1829
	Off support	562	0	562
	Total	1305	1086	**2391**

Appendix I Data

Table I.1. Summary Statistics of Variables

Variable	Town	Mean	S.D	Min	Max	p>|t|
Age (years)	Urban	41.14	15.81	14	88	
	Rural	41.91	15.32	13	87	0.09
Schooling (years)	Urban	2.02	3.22	0	13	
	Rural	0.78	1.93	0	13	0.00
Experience (years)	Urban	15.53	12.91	1	72	
	Rural	16.36	13.28	0	78	0.04
Concentration of micro enterprises in same district and different industry (employment)	Urban	0.94	0.36	0.001	2.05	
	Rural	0.66	0.72	0.001	6.57	0.00
Concentration of big textile factories in same zone (employment)	Urban	1.30	3.12	0	10.3	
	Rural	0.62	1.57	0	10.1	0.00
Concentration of big manufacturing industries in same zone and different industry (employment)	Urban	1.42	2.03	0	6.21	
	Rural	0.54	0.97	0	6.21	0.00
Market access (population in 100,000 divided by the square of hours to the nearest market place)	Urban	12.79	22.54	0.001	57.70	
	Rural	2.22	10.83	0.0001	69.12	0.00
Hours to the nearest micro finance institution	Urban	0.36	0.58	0.01	4.02	
	Rural	3.93	3.27	0.23	22.5	0.00
Hours to the nearest all-weather road	Urban	0.30	0.50	0.01	2.39	
	Rural	1.59	1.19	0.02	5.71	0.00
Monthly profit per micro enterprise (birr)	Urban	120.62	239.07	-491.0	4432.0	
	Rural	45.44	93.08	-724.0	985.0	0.00

Appendix II Balancing tests

Table II.1A. t-test for each variable before and after the match for urban areas.

Variable	Sample	Mean Clustered (treated)	Mean Dispersed (non treated)	t-test p>|t|
Male (dummy)	Unmatched	0.80	0.41	0.00
	Matched	0.79	0.80	0.73
Age	Unmatched	39.12	43.33	0.00
	Matched	39.05	40.20	0.49
Age squared	Unmatched	1795.80	2102.00	0.00
	Matched	1756.80	1910.80	0.32
Schooling	Unmatched	2.65	1.34	0.00
	Matched	2.47	2.36	0.71
Experience	Unmatched	16.02	14.99	0.08
	Matched	15.33	18.28	0.03
Experience squared	Unmatched	433.54	379.78	0.06
	Matched	377.77	539.12	0.02
Concentration of micro enterprises in same district and different industry	Unmatched	1.09	0.77	0.00
	Matched	1.11	1.08	0.22
Concentration of big textile factories in the same zone	Unmatched	0.32	2.36	0.00
	Matched	0.21	0.20	0.94
Concentration of big manufacturing factories in the same zone and different industry	Unmatched	0.55	2.36	0.00
	Matched	0.32	0.42	0.30
Market access	Unmatched	21.17	3.66	0.00
	Matched	25.08	21.68	0.23
Hours to the nearest micro finance institution	Unmatched	0.37	0.34	0.31
	Matched	0.31	0.51	0.03
Hours to the nearest all-weather road	Unmatched	0.18	0.43	0.00
	Matched	0.15	0.22	0.14
Addis Ababa (dummy)	Unmatched	0.64	0.14	0.00
	Matched	0.74	0.68	0.25

Table II.1B. Chi square test for the joint significance of variables

Sample	Pseudo R2	LR chi2	p>chi2
Unmatched	0.38	1047.02	0.00
Matched	0.03	16.24	0.23

Table II.2A. t-test for each variable before and after the match for rural areas

Variable	Sample	Mean Clustered (treated)	Mean Dispersed (non-treated)	t-test p>|t|
Male (dummy)	Unmatched	0.61	0.66	0.02
	Matched	0.60	0.58	0.54
Age	Unmatched	40.95	42.77	0.00
	Matched	41.0	40.57	0.59
Age squared	Unmatched	1910.70	2063.60	0.00
	Matched	1922.4	1889.70	0.66
Schooling	Unmatched	0.96	0.61	0.00
	Matched	0.75	0.86	0.30
Experience	Unmatched	16.38	167.35	0.95
	Matched	16.46	16.8	0.66
Experience squared	Unmatched	449.19	439.88	0.74
	Matched	465.87	505.01	0.35
Concentration of micro enterprises in same district and different industry	Unmatched	0.58	0.72	0.00
	Matched	0.65	0.72	0.09
Concentration of big textile factories in the same zone	Unmatched	0.77	0.48	0.00
	Matched	0.75	0.83	0.43
Concentration of big manufacturing factories in the same zone and different industry	Unmatched	0.68	0.42	0.00
	Matched	0.49	0.57	0.20
Market access	Unmatched	0.05	4.18	0.00
	Matched	0.07	0.06	0.53
Hours to the nearest micro finance institution	Unmatched	4.22	3.66	0.00
	Matched	4.47	4.56	0.59
Hours to the nearest all-weather road	Unmatched	1.80	1.41	0.00
	Matched	2.01	1.92	0.15
Rural town (dummy)	Unmatched	0.32	0.00	0.00
	Matched	0.00	0.00	.

Table II.2B. Chi square test for the joint significance of variables

Sample	Pseudo R2	LR chi2	p>chi2
Unmatched	0.287	949.12	0.000
Matched	0.009	17.65	0.127