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Determinants of industrial embeddedness: Evidence from African manufacturing firms

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Determinants of Industrial Embeddedness

Evidence from African Manufacturing Firms

Abdelrasaq Na-Allah*

February 2011

Abstract

Recent developments in policy initiatives as well as some current practical events have combined to put the spotlight on the issue of industrial embeddedness in sub-Saharan Africa. Though extant research documents, some stylized facts, as determinants of its manifestations of their relevance to realities in the sub-continent, have until now been overlooked. Yet, it is difficult to ignore the fact that its constituent economies possess some peculiar attributes with potentially significant implications for embeddedness behaviour. Using data for the country of Lesotho, a probit model is estimated to ascertain the veracity of some of the widely acclaimed explanatory factors. We find, as we argue, that among all, the issue of supply potentials appears the most important.

Keywords: industrial embeddedness, supplier linkages, manufacturing, probit model, sub-Saharan Africa

JEL classification: L60, F23, O25, O55

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* Abdelrasaq Na-Allah is a Fellow of the South African Research Chair Initiative (SARCHI) at the Institute for Economics Research on Innovation, Tshwane University of Technology Pretoria, South Africa, email: abdelrasaq@yahoo.com, alsuyutina@tut.ac.za

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UNU World Institute for Development Economics Research (UNU-WIDER)
Katajanokanlaituri 6 B, 00160 Helsinki, Finland

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1 Introduction

The centrality of the phenomenon of industrial embeddedness to the prospect of economic development in territorialized locations is an issue around which some recent strands of theories of globalization converge. One analytical posture with lineage to the global value chain theory suggests that industrial upgrading at the national level requires a move from simple assembly of imported inputs to more integrated forms of production involving greater use of both forward and backward linkages (Gereffi 1999). Another intriguing paradigm as revealed in contributions to the emerging works on the Global Production Network emphasizes the importance of local business linkage as a determinant of value retention or value capture. As claimed by its authors, this is what is needed to make gains from participation in the current system of global production and trade networking sustainable in the long-run (Coe et al. 2004). All these are echoes of past sentiments previously expressed in the writings of many notable scholars of regional development that include among others Dicken et al. (1994), Amin and Thrift, (1994), and Conti (1997). In their various demonstrations, suggestions to the effect that strong regional embeddedness of industrial activities is important for significant positive growth spillovers have either been made or implied.

In policy circles as well it is apparent that many of the current frameworks reflect concerns about the need to strengthen regional linkages. Within the realm of efforts to support economic growth in the least developed countries (LDCs) for instance, the cumulation provisions in some of the trade-related development assistance programmes of the more affluent northern donors are designed to encourage local linkages.[1] At a more specific continental Africa level, a recently adopted framework by the African Union entitled the African Productive Capacity Initiative, seeks to promote sustainable industrial development in the region through, among others, the strengthening of production interdependencies within the continent.[2] Running parallel with all these are various programmes at sub-regional and sovereign national levels with strategic mandates to foster industrial embeddedness in their respective local economies.

But perhaps a more emphatic demonstration of the importance of industrial embeddedness to the Africans is found in the recent export crisis that afflicted their garment sector shortly after the Agreement on Textile and Clothing (ATC) came to an end in December 2004.[3] Having left in its wake a trail of negative consequences—no least of which is the closure and subsequent relocation of garment factories to other regions of the world—the issue of enclave practises of firms and what to do to make them develop strong local commitment became a topic (Na-Allah and Muchie 2010).

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1 Two prominent recent examples of these initiatives with focus on Africa are the US 'African Growth and Opportunity Act' Programme that was passed into law in May 2000 and the EU 'Everything but Arms' Scheme which came into existence in March 2001. These schemes have various forms of in-built linkage related cumulation provisions.

2 http://74.125.95.104/u/UAAU?q=cache:qY9g0whPdPUJ:www.africa-union.org/root/AU/Conferences/2007/september/TI/cami/doc/Doc.%252014.doc+apci&hl=en&ct=clnk&cd=1&ie=UTF-8

3 During the ATC tenure the African garment exports enjoyed privileged access to some industrialized countries' internal markets because quota restrictions on similar exports of some others were in force.

Despite these realities, relatively little is known about what determines industrial embeddedness in a sub-Saharan African (SSA) context. Although extant research documents some important stylized facts, it is surprising that their relevance has so far been confined to studies of developed and some non-SSA developing economies. For a survey of these works, see UNCTAD (2001) and for more recent studies see Crone and Watts (2003) and Williams (2005). Some exceptions to this are, however, the linkage-related works of Kirsten and Rogerson (2002) and Barnes and Kaplinksy (2000), both focusing on South Africa, as well as Arimah (2001) whose research examined the determinants of linkages between formal and informal enterprises in Nigeria.

Besides the fact that the different analytical paradigms adopted for these works differ from the one adopted here it is also important to point out that South Africa, and to some extent Nigeria, that were the empirical subjects of the above mentioned investigations, qualify only as outliers and not as suitable proxies for a typical SSA economy. This is because some of the key defining attributes of a truly representative economy from the sub-continent like small market size and landlockedness are not generally associable with these two economies. Yet, these are attributes which, when their potential implications for embeddedness behaviour of firms are considered alongside those of other incumbents like agricultural dependence and poor socioeconomic environment a useful perspective to the debate may be uncovered.

For instance, in the current literature on the determinants of linkages emphasis appears to be more on the demand-related factors whereas it is likely that for reasons just mentioned supply-related factors may be more relevant in a SSA context. We can legitimize this expectation on a number of grounds: (i) the attribute of agricultural dependence would almost certainly restrict supplier availability to the incumbent sector, (ii) small market size can hardly support a large number of firms needed to make demands for inputs significant and local investment in their production attractive, and (iii) by virtue of being embedded in a landlocked and inefficient socioeconomic environment it is not unlikely that relative competitiveness of domestic suppliers would be compromised.

Against this background our paper contributes to the debate by conceptually fine-tuning the supply-side argument and empirically situating the investigation within the context of a typical SSA economy. The small landlocked country of Lesotho, which in our opinion accurately embraces our implied definition of an African economy, has been chosen for the study. Consequently data from The World Bank investment climate survey that was completed for the country's private sector enterprises in 2004 is used to specify and estimate an ordered probit model for establishments in the sample. In accordance with our expectations, results reveal that no other factor than local supply potentials is more important in explaining the incidence of industrial embeddedness in the country.

The rest of the paper is organized as follows. Section 2 provides a brief review of the theoretical and empirical foundation for the various factors that are considered to be important in the analysis of the determinants of embeddedness formation. This is followed by a description of the data, methodology, and presentation of results in Section 3. Our concluding remarks are given in Section 4.

2 Industrial embeddedness: key explanatory variables

Early interests in the industrial embeddedness issue, as demonstrated in works by regional scientists like Hirschman (1958) and Perloff et al. (1960), were inspired by a desire to maximize the full development potentials of industrialization. However, studies that have evolved within the last decade or so have primarily been driven by the pressures of globalization (Ohmae 1995; Yeung 1998) that some analysts fear are leading to an increasing level of enclave behaviour by multinational subsidiaries (Turok 1993). A major preoccupation of this literature therefore lies with understanding the set of required conditions for integrating or 'tying' a focal firm to the region of its operation.

Conceptually, industrial embeddedness can be viewed as the creation of a continuous inter-firm relationship between a focal firm and others in a region. To the extent that the former becomes dependent on supply of its inputs and related services, or sales of its output on the latter, the 'tying to the region' requirement for local integration or linkage formation is assumed satisfied. From this broad conceptualization it is possible to identify two basic manifestations of the embeddedness phenomenon. The first one concerns the kind of dependence that is conferred by virtue of a focal firm's reliance on other firms for sales of its output (forward integration). When such dependence is of the type that places a firm at the mercy of others for supplies of input materials the second form is revealed. In this study our concern is with this latter manifestation which is commonly referred to in the literature as backward integration.

The literature emerging from this strand of research has over the years advanced various explanations for the degree of backward linkages that are assumed by enterprises within their host economies. These explanations can be thought of as essentially describing various aspects of demand and supply side attributes.

2.1 Demand side attributes

Linkage potentials have been argued to be related to certain demand attributes of firms as may be defined by such important factors as industrial affiliation, size, ownership, age, market condition, and degree of autonomy.

It is possible to identify two basic criteria for distinguishing between firms of different industrial affiliations. These are differences with respect to both complexity of production technology and product demand characteristics (Crone and Watts 2003). Linkages are usually low in the high-tech sector because capacities to produce complex inputs that are demanded by firms in the sector are not widely distributed. Perhaps the empirical reality that foreign affiliates in the garment industry with relatively sophisticated input needs display a low level of regional linkages in a survey of Costa Rica, the Dominican Republic, and Morocco is a confirmation of this hypothesis (UNCTAD 2000). On the other hand it is likely that low-tech industries with relatively uncomplicated input requirements will find their demand met by local suppliers and will thus exhibit high level of regional sourcing. This may well be the case with the finding that the food processing industry tends to be strong on local linkage formation since its input needs mainly come in the form of unsophisticated basic agricultural produce (UNCTAD 2001).

Classifying industries by product demand characteristics reveals a differentiation between demand for standardized and unstandardized products. It is argued that standardized inputs can easily be procured from far distances as suppliers already know in advance what is required in terms of product specifications and other details. Firms in such industries will therefore exhibit a low linkage profile. However, industries requiring specialized (unstandardized) inputs have reasons to source locally because of the degree of close monitoring required to produce such products. In a study of the determinants of regional sourcing by multinational manufacturing firms in the UK, Crone and Watts (2003) raised and confirmed this hypothesis by showing that firms producing customer specific products with unstandardized input requirements had a significantly higher level of regional linkage than firms producing standardized products.

The size of the buying plant is another demand-related factor that has been discussed in the literature. Because of the potential large order requirements of large firms and the possibility that local suppliers may not possess the needed capacity to meet such high demand, it is reasoned that large-scale manufacturers will show greater inclination for out-of-region sourcing. Empirical support for this hypothesis is available in a number of studies. For instance, Barkley and McNamara, (1994) find that larger operations are associated with relatively lower domestic input purchases in the US states of Georgia and South Carolina. Gorg and Ruane (2001) also report similar findings for the Irish electronic sector.

One of the most widely acknowledged factors in conceptual and empirical treatments of industrial linkages is the impact that firm ownership exerts on demand preference for local input. Distinguishing between foreign and indigenous ownership, claims have been made that firms in the former group are not likely to be locally oriented as much as those in the latter. One intuitive justification for this line of reasoning is the fair chance that exists for indigenous enterprises to have better knowledge of the local supply market which makes patronage relatively less risky. Although Barkley and McNamara's (1994) work falls short of finding support for this proposition, more recent attempts document evidence in line with predictions of the theory (Tóth 2000; UNCTAD 2000). A related hypothesis along this line of ownership issue is the suggestion that the nationality of firms plays a role in determining sourcing preferences. Japanese firms have especially been the main target of this kind of analysis. Because of their inclination to maintaining close inter-firm network, it has been pointed out that subsidiaries of Japanese *keiretsu*[4] tend to exhibit weak linkages with their host economies (Rawlinson and Wells 1993). In recent studies, the focus has moved to Europe with contributions from Chesnais et al. (2000) for instance suggesting that non-European firms operating in Europe are likely to be more Eurocentric in their sourcing behaviour than their European counterparts (ibid.).

Closely linked with geographical identity is the geographical spread factor. Some firms belong in conglomerates with extensive operations that are spread across many countries. Because such membership facilitates access to information on global sourcing

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4 *Keiretsu* is a Japanese term for a conglomerate headed by a major Japanese bank or one consisting of companies with a common supply chain linking wholesalers and retailers

practices, demand preferences of these firms will, in comparison with others without such networks, likely be biased in favour of global sourcing. Therefore, the prediction is that network membership will negatively affect the degree of local embeddedness.

Furthermore, the notion that demand preference for local input is positively related to age of the buying plant is supported by two principal arguments. (1), the learning curve hypothesis advanced by O'Farrell and O'Loughlin (1981) postulates that the kind of confidence and trust in the capacity of local suppliers needed by multinational subsidiaries to engage in local patronage often takes time to build. Therefore, the longer a firm stays in a region the higher the chances for linkage development. (2), differences in the degree of local sourcing between old and new firms may also reflect the possibility of inertia. Older firms may be reluctant to change from old established and possibly regional sourcing habits while their younger counterparts may be more disposed to the global dimension that recent sourcing trends have taken (Phelps 1997). Most studies that relate age to degree of local embeddedness have generally confirmed its theoretical prediction (Handfield and Krause 1999; Gorg and Ruane 2001).

Demand preference can also be shaped by market condition facing a firm as well as the strategy of an organization. Firms in highly competitive markets where price sensitivity is an attribute are generally perceived as having preferential disposition for global sourcing where the best price deal can be struck (Laurisden 2004). On the other hand if an organization adopts a decentralized strategy that places a significant amount of power and autonomy in the hands of its subsidiaries it is very likely that such a subsidiary plant will buy more from the locals than their counterparts with centralized strategy (Zanfei 2000).

2.2 Supply side attributes

As a usual suspect in most analyses of constraints to regional economic development, it is not surprising that the question of capacity to supply has come to feature in the industrial embeddedness literature. What is surprising, however, is the realization that it has received little attention in empirical studies (Crone and Watts 2003) and can arguably be described as the least investigated factor. In line with its analytical orientation authors who have modelled this variable as a function of linkage behaviour have generally predicted, just as the converse is also the case, that firms in regions with robust supply potentials will literally exhibit stronger regional ties than their counterparts in a relatively poor supply environment. Of obvious interest, however, is the crucial task of defining the attributes of a good supply environment.

A useful way of approaching this issue is to recognize that while availability of domestic suppliers of input materials will necessarily constitute an incontrovertible credential it is not sufficient unless such availability can be expressed in terms of relative competitiveness with suppliers in other locations. In other words arguing from the supply side perspective we will expect the extent of a firm's local linkage to be shaped not only by the fact of strong local presence of input suppliers, but also by that of their relative competitiveness with others elsewhere.

One can fathom from recent contributions to research that the phenomenon of regional presence with respect to availability of domestic suppliers with sufficient capacity to meet both quantity and quality requirements of buying firms can be explained by two key regional attributes. These are size, as well as industrial identity of the region in

question. The theory that regional size, as may be revealed in national economic size, matters for supplier presence and is premised on the logic that in large economies where concentration of multitudes of both large and small manufacturing firms is an attribute, the demand for industrial input materials will be significant enough to make investment in the upstream operations attractive. Conversely, small-sized economies like SSA economies can, by virtue of their inherent inability to support large number of plants in their regions, be judged as less likely to succeed in generating the kind of input demand volume needed to enable suppliers to flourish. For their potentials to facilitate the emergence of domestic suppliers local linkage possibilities will be brighter for large economies than for small ones. Twomey and Tomkins (1996) confirm this hypothesis for the UK while a related focus on Japanese plants in the USA by Reid (1995) finds no such evidence.

Related to the above idea of size factor is the structural identity of an economy. Some economies can be so profoundly attached to a single or few interrelated sectors that one can understandably equate the identity of such sector(s) with national economic/industrial identity. While this may not necessarily be a feature to be observed with a typical relatively diversified western economy it rears its head sufficiently well in SSA to merit special attention. For instance, it is a common knowledge that many of the continental economies are described as unsophisticated simply because their structural profiles are so significantly skewed in favour of the dominance of agricultural and low-tech light manufacturing activities.

As a variable influencing the incidence of supplier presence we might expect that since the sector(s) with commanding presence will show higher demand for input than others with inferior status its input/supply market is also more likely to be well-developed. Put in a different way, this argument implies that it is hardly likely for us to find sufficient suppliers of say, high-tech rather than low-tech industrial input in regions dominated by low-skilled and uncomplicated economic activities.

The revealed identity of SSA economies, to which reference was made to earlier, thus implies that firms belonging to sectors like food and beverages and other light manufacturing, will have little problem sourcing their input locally as suppliers will readily come in handy. For the related reason that the performance of high-tech industrial activities, like those typical of engineering and biotechniques, is very negligible in many of these countries its input market will also be correspondingly underdeveloped and few (if any) of its suppliers will be available. This argument will make us expect linkage development prospects to be brighter for firms in industries with established regional presence. An early study by Barkley and McNamara (1994) mentioned previously illustrates the importance of a well-developed supply base to the prospects for linkage formation. It is shown in their work that manufacturers in industries with a highly developed input market display stronger local ties than their counterparts.

Even if suppliers are sufficiently available in a locality there is definitely no guarantee that its resident firms will engage in any significant patronizing behaviour. This is because the criterion of market competitiveness that relates cost and quality of domestically produced items to those of extra-regional locations still has to be met. Past research has probably taken it for granted that for many industries firms are regionally confined in terms of their sourcing scope. Approaches of this sort can be understood within the context of the fact that in the recent past, the performance of the whole range

of value adding activities required to transform an idea into a finished product, was essentially confined within national boundaries. But with the advent of globalization where production sharing across boundaries is an essential attribute it is increasingly becoming easier for firms to jettison uncompetitive local suppliers for the friendlier global markets.

Indeed, in recognizing here that some regional suppliers may not be internationally competitive we are inadvertently drawing attention to a very disturbing reality in SSA. It is well known that suppliers in the region operate in highly uncompetitive environments where costs of doing businesses are relatively high. Among some of the key factors raising the competitive stakes for input suppliers are such regional economic attributes as landlocked geography, poor physical infrastructures, unskilled labour, institutional weaknesses, underdeveloped systems of financial intermediations, etc. If these environmental circumstances do impact negatively on suppliers' ability to be efficient and become internationally competitive as it is likely, we should expect a diminished prospect for linkage development in the region.

3 Data, methodology, and results

3.1 Data environment

Data for the study is a cross-section one that comes from a survey of manufacturing establishments in Lesotho. As a typical SSA economy the country exhibits some significant deficiencies in the main pillars of support for industrial development. For instance, like some of its regional neighbours it is according to the United Nations classification a LDC. Its per capita income of US$550 in 2004 mirrors that of SSA average of US$611. The negative implication that this has for market demand is further strengthened by a population figure that stood at less than 2 million in 2004.[5]

Again, like many of its SSA neighbours economic competitiveness is haunted by a landlocked geography that makes its share all of its border areas with South Africa. A further compounding the problem is the absence of key environmental efficiency drivers like strong economic, social, and institutional infrastructures. Based on the 2007 Global Competitiveness Index report Figure 1 below shows that Lesotho's competitiveness performance indicator of 3.24 which somehow mimics that of SSA average of 3.29 is worse off in comparison with China, India, Brazil, and even South Africa.[6]

Lesotho's dependence on agriculture is also typical of an average SSA country although the World Bank recently reckons that this dependence has been declining over time

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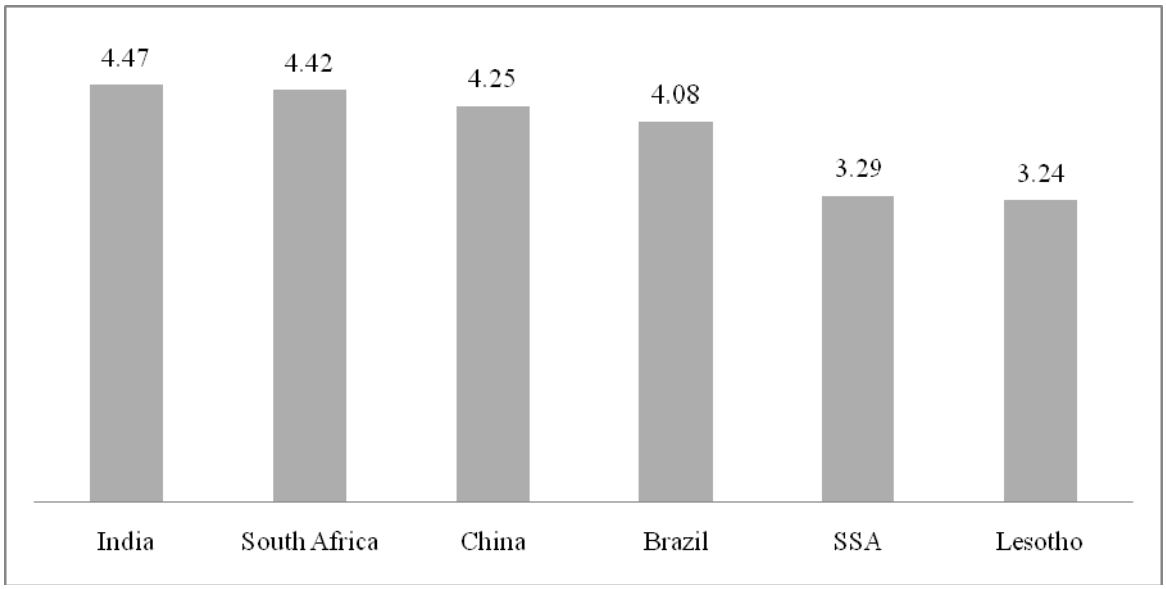
5 See World Bank (2004) 'Environment at a Glance 2004 Lesotho', Available at: http://siteresources.worldbank.org/INTEEI/Data/20857101/Lesotho.pdf, accessed 2 August 2008.

6 The Global Competitiveness Index Report is a product of the World Economic Forum's attempt to capture and reveal the competitive potentials of countries. For each country, the report measures and rates the level of development of a number of factors considered to be drivers of national productivity and general economic competitiveness. Factors considered in this 2007 exercise include: institutions, infrastructure, macroeconomy, health and primary education, higher education and training, market efficiency (goods, labour, financial), technological readiness, business sophistication, and innovation. See http://www.weforum.org/en/initiatives/gcp/Global%20Competitiveness%20Report/index.htm

Figure 1: An index of Lesotho economy's relative competitiveness with selected comparator economies



Source: World Economic Forum, Global Competitiveness Index Report (2007).

(World Bank 2003). As it will soon be revealed this attribute in a way defines the kind of manufacturing activities that the economy is able to support.

The cross-section survey to which our data refers is for 2002 as a reference year and was obtained from the database of the World Bank coordinated Investment Climate Assessment exercise conducted and completed for about 75 manufacturing establishments in the country around the end of 2004. The small sample size which was carefully drawn to provide adequate representation of the broader population is itself a reflection of the broader economic size of the country.

3.2 Variable definition

Being an exercise that was principally motivated by a need to have better understanding of conditions in the local investment climate and how they are affecting firm performances the survey questionnaire addressed a number of wide-ranging issues. We were able to extract some key variables of interest from the resulting database for employment in the analysis that was undertaken. A background discussion on these variables together with how they have been measured follows next.

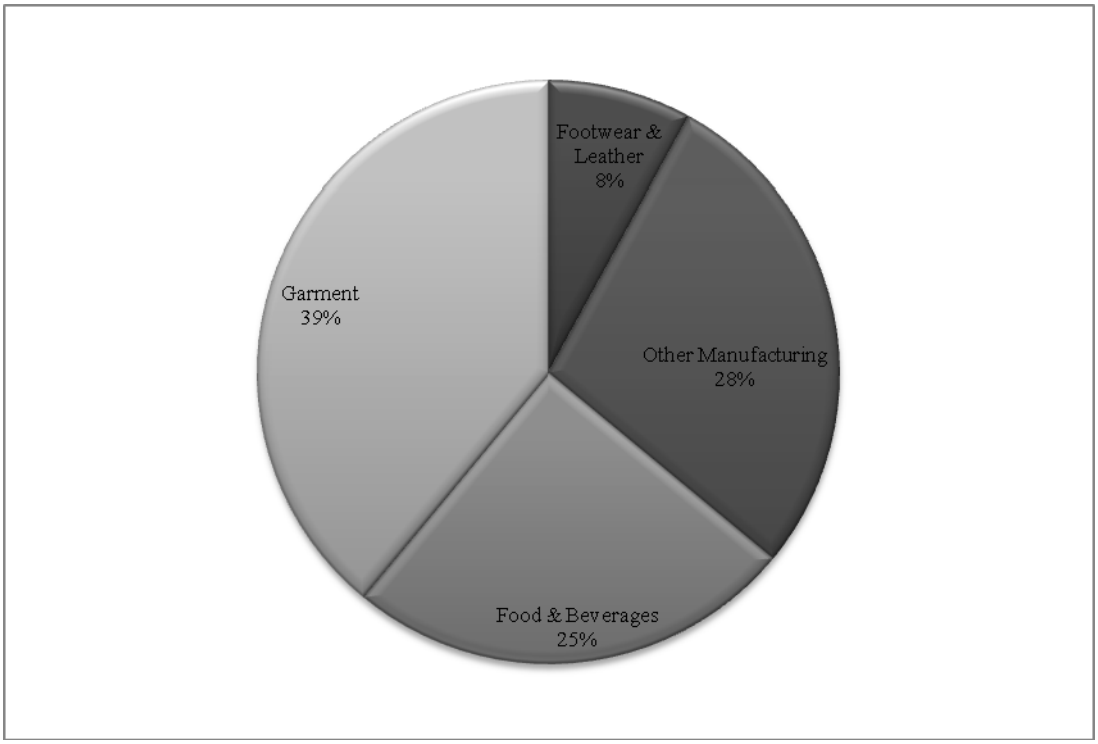
3.2.1 Industrial sector

An important feature of the manufacturing sector in Lesotho is that it is relatively unsophisticated and for the most part allied with the primary sector. The incidence of these attributes cannot be divorced from the country's relative backwardness and its history of dependence on agriculture as previously suggested. It is quite obvious from Figure 2 below that not only are the high-tech sectors completely unrepresented in the data, but also the dominance of light manufacturing is also evident. Accounting for almost 50 per cent of the total number of firms in the sample, the industrial identity of

this economy seems to be revealed in low-tech garment (including leather and footwear) manufacturing activities.

From the classification in the figure four dummy variables were generated to capture the influence of sector in the empirical specification. These are *fb, gt, lf*, and *om* for food and beverages, garment, footwear and leather, and other manufacturing respectively. For each of the four variables a value of 1 is assigned for positive observations and 0 otherwise. Based on previous discussions in Section 2 we know that food and beverages belong to the low-tech category of manufacturing with relatively uncomplicated input requirements. This will make us to expect a positive sign for its variable. However, with respect to garment the likely direction of its sign cannot be foretold. On one hand, by virtue of having a relatively complicated input requirement in textile as argued earlier, Lesotho may not have the right supply capacity. On the other hand, having its industrial identity revealed in garment and related light manufacturing activities may confer on its good supply potentials in inputs that feed into their production. Positive signs can be expected for the remaining variables (*lf* and *om*) because they generally belong to low-tech category of manufacturing.[7]

Figure 2: Distribution of survey firms by sector



Source: Author's calculation based on information from the World Bank Enterprise Survey database.

7 The World Bank defines other manufacturing as firms in varieties of other light manufacturing sub-sectors that include construction materials and printing.

3.2.2 Embeddedness

Embeddedness is captured by the degree of backward integration that firms assume within the local economy. In other words, it is the extent of manufacturing establishments' linkage formation with domestic suppliers of input. Consistent with the popular approach in the literature this variable which serves as the explained variable in the model is measured as a percentage of a firm's material inputs and supplies procurement in 2002 that came from domestic sources (Williams 2005; Reid 1995). With domestic sources being defined as purchases made from manufacturers, distributors, or foreign-owned firms in Lesotho, responses vary between 0 and 100 per cent.

As a backward economy it does not come as a total surprise to notice from column 2 in Table 1 that the domestic component of input purchases is for all sectors generally low (less than one-quarter). Also, the observation that firms in the food and beverages sector are the most significant customers of domestic suppliers could be saying something about strong sectoral supply base in an agriculture-dependent economy. Discussion on how the variable was introduced into the model is provided in the latter part of this section.

Table 1: Distribution of firms by levels of local patronage and foreign presence

Sector	Local patronage (%)	Foreign presence (%)
Food & beverages	42.8	12.5
Garment	18.8	74
Footwear and leather	1.7	66.7
Other manufacturing	30.8	40
Average (all sectors)	23.5	48.3

Source: Author's calculation.

3.2.3 Foreign ownership

An important assumption in the literature on foreign direct investment (FDI) is that the decision to engage in off-shore production is generally driven by a *resource-* or *market-seeking* motive. Given that Lesotho neither presents an economy with large market demand potentials nor has any known natural resource of significance from the FDI attraction point of view, one is left to wonder whether the substantiality of average foreign presence in manufacturing (at nearly 50 per cent for all sectors) as revealed in column 3 of Table 1 is not an empirical absurdity. But the idea that market motive may not entirely be ruled out of favour is revealed when we take a closer look at the sectoral dimension of this foreign representation. The two sectors with significant foreign presence (garment and leather and footwear) are technically the sectors with substantial market potentials as Lesotho's trade agreements with the West gives its outputs from the sectors preferential access to the larger markets of these western countries.

In defining the foreign ownership variable we simply made a distinction between African and non-African owned establishments and classified the latter group as foreign organizations. While we recognize that this variable can be better represented, as it is often the case, by firms owned and controlled by nationals of the focal economy, our leverage is constrained by limitations of the data. The classification of firms' nationalities in the data only reveals a differentiation between firms of African, Asian,

and European stocks with the Lesotho sub-group impliedly subsumed within the larger African group. This inability to break down results by nationalities is, according to the World Bank, an inevitable consequence of dealing with a poor small economy where relatively few numbers of firms are available for observation. In any case, since the objective is to analyse embeddedness in the context of the SSA economy, restricting the definition of foreigners to only non-African entrepreneurs, may even be the more appropriate thing to do.

For econometric purposes, firms identified in the sample as belonging to foreign (non-African) category of proprietors are assigned the value of 1 while a value of 0 is assigned for each of those entrepreneurs falling into the class of African shareholders. An inverse relationship is expected between foreign ownership and backward integration.

3.2.4 Supply capacity deficits

The suggestion from our discussions in Section 2 that the regional supply potential is a country rather than firm level phenomenon raises important questions on the feasibility of modelling this variable in a single country focus like this one. From an empirical analytical point of view it seems more meaningful to introduce the influence of the regional supplier presence or their competitiveness in a cross-country regression framework where differences across countries can easily be revealed.

In the context of a single country analysis however, Hoare (1985) made an insightful contribution that makes it possible for us to get around this problem. The scholar had argued that, in determining the level of local patronage, firm managers' perceptions of the availability and competitiveness of domestic suppliers can be taken to be just as important as the reality itself (ibid.). It follows from this viewpoint that if we can figure out the kind of judgements that Lesotho firm managers have on the availability and competitiveness of local suppliers we should have a fairly good proxy for modelling the influence of supply capacity in our empirical equation.

Fortunately, data available for analysis allows for some leverage in this regard. One of the survey questions had particularly addressed the issue by requiring respondents to identify from a list of factors some of the key obstacles that prevent them from patronizing local suppliers. Three of the listed factors which allow some extrapolations to be made on respondents' perceptions are:

- There are no local suppliers,
- Local suppliers do not have sufficient capacity to meet orders, and
- The quality of local supplies is inadequate.

From column 2 in Table 2 it can be observed that roughly 41 per cent of respondents claimed there were no local suppliers. This appears to be the main supply side issue inhibiting the prospect for linkage development. A possible interpretation that this is suggesting an inability, on the part of a small economy, to support a well-developed input market is further reinforced by the revelations in columns 3 and 4 that higher proportions of large-sized firms are dissatisfied on all fronts with local supplies conditions.

The technique adopted to model the impact of this variable places respondents who mentioned one or more of these factors as explanation(s) for being unfavourably

disposed to local sourcing in the category of those who have poor impression of the country's supply potentials. In this respect observations with positive outcomes are assigned the value of 1 while others are captured by 0 values. Local sourcing by the former group of respondents (i.e. observations with positive values), if it ever took place at all would at best be minimal. We are thus inclined to expect the association between this variable and local embeddedness to be negative.

Table 2: Perceptions by size of respondents' firms on the availability, capacity, and quality of local suppliers

Supplies condition	All firms (%)	Large firm (%)*	Small firms (%)**
There are no local suppliers	40.6	52	48
Local suppliers do not have sufficient capacity to meet orders	23.4	58	42
Quality of local suppliers is inadequate	18.8	56	42

Note: Workers < 100; **workers > = 100.

Source: Author's calculation.

3.2.5 Size and age

To capture the influence of size four dummy variables that discretely classify firms into micro, small, large, and very large plants were generated. A micro firm (mcsz) has in its payroll between 1–9 employees, while the range for a small-sized enterprise (ssz) is given as 10–99 workers. The staff strength of a large organization (lsz) falls within the band of 100 and 499. If total number of workforce exceeds 500, then such firm is considered to be of very large size (xlsz). Consistent with our earlier arguments, large size variable is expected to be negatively associated with linkage levels.

The determination of a firm's age (*age*) is a straightforward issue. It is accomplished simply by defining a benchmark of five years below which firms are considered unqualified, considered old, and are captured by the value of 0. It therefore follows that old establishments are those that as at 2002 have spent up to five years or more in operation. This variable which is assigned the value of 1 is unlike size expected to be positively associated with domestic sourcing. The choice of five years as our benchmark is not without precedent. Williams (2005) used a similar value in his analysis of supplier linkages of foreign-owned manufacturing firms in the UK. As shown in the summary statistics of Table 3 firms in the sample have a mean employment figure of 309.25 and close to 60 per cent had been established before 1997.

3.2.6 Network membership

Finally, the last variable that was introduced proxies for the incidence of belonging in a conglomerate group. We were able to model the influence of this factor by utilizing respondents' answers to a question which required them to state whether or not their firms had operations in other countries. Organizations with affirmative answers are classified as being members of a network group and are given the value of 1, otherwise 0. The coefficient of this explanatory variable is anticipated to show up with a negative sign.

Table 3 below presents summary statistics for all variables while the expected signs of the explanatory factors are given in the Table 4.

Table 3: Summary statistics

Variable	Observation	Mean	Std dev	Min	Max
Dep. var (emb)	70	1.29	1.66	0	4
Micro size (mcsz)	75	0.12	0.33	0	1
Small size (ssz)	75	0.31	0.46	0	1
Large size (lsz)	75	0.20	0.40	0	1
Xlarge size (xlsz)	75	0.17	0.38	0	1
F&b sect (fb)	75	0.25	0.44	0	1
Garment sect (gt)	75	0.39	0.49	0	1
F&l sect (fl)	75	0.08	0.27	0	1
Other maf (om)	75	0.20	0.40	0	1
Foreign(frgn)	69	0.49	0.50	0	1
Network (ntw)	74	0.30	0.46	0	1
Supp. capacity (scd)	75	0.43	0.50	0	1
Age (age)	75	12.25	15.05	-1	91

Source: see text.

Table 4: Variable descriptions and expected signs

Variable	Description	Expected sign
fb	Food & beverage sector	Positive
gt	Garment sector	Unknown
fl	Footwear & leather sector	Positive
om	Other manufacturing sector	Positive
frgn	Foreign ownership	Negative
scd	Supply capacity deficits	Negative
size (lsz; xlsz)	Firm size	Negative
age (5 years +)	Firm age	Positive
ntw	Network membership	Negative

Source: see text.

3.3 Estimation technique

The discrete nature of the dependent variable (embeddedness) requires that we think through the appropriate econometric technique to use. Obviously because of its discontinuity the standard least squares technique is ruled out of favour. One option is to treat responses in terms of binary choice that indicates linkage or no linkage. But this will not capture the degree of embeddedness which is more meaningful in an analysis of this type (Williams 2005). Another option is to view responses as ordered since it is possible to distribute the percentage share of local content of input procurement into ordered categories. While this will definitely eliminate the usefulness of a technique such as multiple discriminant analysis it will make the choice of ordered probit model quite appropriate.

The ordered probit method models ordered response data in terms of an underlying latent variable such that

$$\ddot{y} * i = xi\beta + ui \qquad (1)$$

where i = 1…… n, β and x_i are vectors of unknown parameters and variables believed to possess explanatory powers respectively. u_i is a stochastic error term that follows a normal distribution, while $\ddot{y}^*_i$ is the unobserved dependent variable which is related to the observed dependent variable $\ddot{y}_i$ as follows

$$yi = \begin{cases} 1 \text{ if } y*i < \acute{\alpha}1 \\ 2 \text{ if } \acute{\alpha}1 <= y*i < \acute{\alpha}2 \\ 3 \text{ if } \acute{\alpha}2 <= y*i < \acute{\alpha}1 \\ J \text{ if } \alpha\ J\text{-}1 <= y*i \end{cases} \qquad (2)$$

The model recognizes a natural ordering in the values of the dependent variables such that the threshold parameter α1< α2< α3…. < α *J*-1. If we denote the probability of a particular observed outcome being associated with *yi* by Pr (*yi* = *j*), we have the following expression

$$\Pr(yi = j) = \Pr(\alpha j - 1 < y*i < \alpha j) = \Phi(\alpha j - xi\beta) - \Phi(\alpha j\text{-}1 - xi\beta),\ j = 1, 2, 3, \ldots J \qquad (3)$$

where Φ(·) defines the cumulative distribution function. A maximum likelihood estimation technique is used to estimate the model after transforming it into log-likelihood function as follows

$$LogL = \sum \ln[\Pr(ji)] = \sum \ln\left[\Phi(\alpha\, ji - xi\beta) - \Phi(\alpha\, ji - 1 - xi\beta)\right] \qquad (4)$$

Maximization in the above equation is carried out with respect to threshold parameters α1, α2, α3... α *J*-1 as well as elements of β.

To ensure that outcomes are not context specific two versions of banding for the explained variable were considered. The first calibrated the percentage of input usage that are of domestic sources into four discrete ordered choice categories that take on a range of values between 0 (no linkage) and 3 (high linkage) as follows

Model 1

$$embd = \begin{cases} 0 \text{ if } yi = 0\% \text{ (no linkage)} \\ 1 \text{ if } 0 < yi \leq 33\% \text{ (low linkage level)} \\ 2 \text{ if } 33\% < yi \leq 66\% \text{ (moderate linkage level)} \\ 3 \text{ if } 66\% < yi \leq 100\% \text{ (high linkage level)} \end{cases} \qquad (5)$$

The second has the following five ordered classification.

Model 2

$$embd = \begin{cases} 0 \text{ if } yi = 0\% \text{ (no linkage)} \\ 1 \text{ if } 0 < yi \leq 25\% \text{ (low linkage level)} \\ 2 \text{ if } 25\% < yi \leq 50\% \text{ (moderate linkage level)} \\ 3 \text{ if } 50\% < yi \leq 75\% \text{ (high linkage level)} \\ 4 \text{ if } 75\% < yi \leq 100\% \text{ (very high linkage level)} \end{cases} \quad (6)$$

where *embd* is the extent of local embeddedness that we measured as percentage of material input procurement in 2002 which originated from domestic sources. Consequently our equation for estimation is given by

$$embd = ssz, lsz, xlsz, fb, gt, fl, frgn, age, scd, ntw \quad (7)$$

embd is as defined above, *ssz, lsz,* and *xls* are all size dummies that stand for small, large, and very large sizes respectively. Sectoral dummies are also introduced as *fb* (food and beverages), *gt* (garment) and *fl* (footwear and leather). *frgn* stands for foreign ownership attribute while *age* is the proxy for the event of being old in the business. Both regional supply capacity deficits and network membership are given by *scd* and *ntw* respectively. In order to avoid collinearity both micro size (*mcz*) and other manufacturing (*om*) variables were dropped from the estimation. The heteroskedasticity problem was also dealt with by following the method suggested in Harvey (1976).

3.4 Results

Adopting a general-to-specific method of model selection, Table 5 presents results for two different specifications of Model 1 (Model A and Model B).[8] Model A is the more general form with all explanatory variables included while model B represents results for the most parsimonious or best fitting equation. In Model A, whose output is contained in columns 2 and 3, four of our explanatory variables large size (*lsz*), age (*age*), foreign ownership (*frgn*), and supply capacity deficits (*scd*) were statistically significant. The variables for small size (*ssz*), very large size (*xlsz*), and footwear and leather (*fl*) sector turned up with p-values above 0.4 and were thus dropped from the estimation. The regression output for the restricted version comprising the remaining seven variables is reported in columns 4 and 5 under Model B. Both Bayesian information criterion (BIC) and Akaike's information criterion (AIC) suggest that Model B is an improved specification over Model A.

In analysing the result, the focus is therefore on Model B. With the exception of *ntw* all variables retained in this model were statistically significant. The results generally confirm the conventional wisdom in the literature that large size, foreign ownership, and poor regional supply potentials exert negative influences on local input procurement

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8 In results not reported here we tested the sensitivity of the estimates to changes in width banding for the explained variable by estimating Model 2 and find that there is practically no difference in the regression outputs of the two models.

Table 5: Ordered probit regression results for the embeddedness equation

	Model A		Model B	
Variable	Coef	P>|z|	Coef.	P>|z|
ssz	0.26	0.55	--	--
lsz	-1.73	0.01	-1.73	0.01
xlsz	-0.46	0.48	--	--
fb	0.79	0.11	0.85	0.06
gt	0.95	0.12	0.96	0.04
fl	-0.54	0.53	--	--
age	0.76	0.08	0.77	0.07
ntw	-0.50	0.31	-0.61	0.19
frgn	-1.19	0.01	-1.42	0.00
scd	-0.98	0.01	-1.04	0.01
Number of obs	64		64	
Log likelihood	-43.898769		-44.849864	
BIC	-124.305		-134.880	
AIC	1.778		1.714	

Source: see text.

while affiliation with the food and beverages sector as well as the establishment's age confer positive impacts. The observed positive association between the garment sector variable and the dependent variable was also not totally unexpected.

An examination of marginal effects of the significant variables on predicted probabilities reported in Table 6 sheds further lights on all these. The table shows that large size establishments with 100–499 employees have an approximately 18 per cent lower probability of being strong on embeddedness (linkage 3) than microenterprises (1–9 employees). Also in contrast with recent evidence from Europe as in William (2005) that there is no support for the claim that embeddedness is related to the phenomenon of foreign presence, our finding reveals that there is indeed a negative association between the two. Evidence contained in Table 6 shows that foreign presence reduced the probability of high linkage formation by nearly 28 per cent. Furthermore, the supply capacity deficit variable is seen to have diminished the prospects of having linkage 3 by about 19 per cent in 2002.

With respect to positive influences, we can confirm that sectoral affiliations with food and beverages as well as garment increased the probability of linkage at the highest level by approximately 21 percent and 20 percent respectively. But for older firms the probability of such linkage formation associates with a roughly 13 percentage point increase. Finally, while it is tempting to associate the level of local sourcing negatively with the incidence of belonging to a network group the insignificant value of its proxy's coefficient makes such conclusion difficult to make.

Table 6: Marginal effects for estimated model

	Linkage 0 (no linkage)	Linkage1 (low linkage)	Linkage 2 (mod. linkage)	Linkage 3 (high linkage)
lsz	0.4666	-0.2641	-0.0231	-0.1794
age	-0.2760	0.1339	0.0146	0.1276
frgn	0.5029	-0.2017	-0.0255	-0.2756
scd	0.3746	-0.1673	-0.0196	-0.1877
fb	-0.3268	0.1043	0.0168	0.2057
gt	-0.3600	0.1375	0.0188	0.2037

Source: see text.

4 Conclusion and policy recommendation

In the light of recent emphases, this paper examines the phenomenon of industrial embeddedness in SSA manufacturing firms. While much of the extant analysis in this area has typically been concerned with non-SSA economies our departure from the literature is both relevant and necessary. It is relevant because Africa presents a unique set of economic attributes with potentially significant implications for linkage behaviour. It is necessary as well, for the simple reason that the recent expiration of ATC quota, which saw many of the continent's resident garment manufacturers fleeing the continent with ease to more attractive locations, made serious policy debate on regional industrial embeddedness apparently inevitable.

Drawing on firm level data from a survey of the private sector in Lesotho, a model of industrial embeddedness was specified for its manufacturing establishments. Results from an estimated ordered probit equation generally confirm the conventional wisdom that large size attribute, foreign ownership credentials, and poor perception of local suppliers do manifest in significant negative linkage spillover. Positive linkage effects are however, in accordance with the proposition, demonstrated in variables that proxied for plant age, food and beverages, and garment sectors.

To unravel the puzzle presented by these findings it seems reasonable to conclude that our expectation of the centrality of the supply-side factor to the prospects of industrial embeddedness in SSA manufacturing has been borne out by evidence. Virtually all the assembled pieces of information explicitly or implicitly made some supply side statements. For instance, besides the negative contribution of the supply capacity deficit variable, the finding that large-sized establishments were unfavourably disposed to local sourcing is probably due to the inability of local suppliers in a typical small African economy to fill large orders. Also, despite the complex nature of its input needs, which is a good enough reason to associate the garment sector with significant negative linkage spillover, the positive sign observed for its coefficient may be picking the impact of good supply potentials that is conferred by the country's revealed industrial identity in garment. Moreover, in an agriculture-dependent economy, the positive linkage claim of the food and beverages sector may not be divorced from the existence of robust local resource base. Therefore, in crafting linkage-related policies in Africa, it is important that concerns shift to fostering the development of a strong local supply base.

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