Are Large-Scale Land Acquisitions in Africa Pro-development? A Network Analysis of FDI in Land and Agro-industry

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1 Introduction

Africa is changing for the best. It is urbanizing at a very high pace and making notable progress in the areas of income per capita, trade liberalization, human capital development, and doing-business indicators (African Development Bank 2018). Sub-Saharan Africa (SSA) is experiencing structural transformation away from agriculture, with falling agricultural share in GDP and employment (Barrett et al. 2017).

However, families in rural Africa still rely essentially on agriculture, as virtually all rural households have an on-farm activity (92% on average across countries) and derive about two-thirds of their income from on-farm agriculture (Davis et al. 2017). Furthermore, rural households in Africa are less engaged in wage employment, both on and off the farm (even after

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controlling for the level of development), resulting in a smaller share of nonfarm wage income in total income (8%) than in other developing regions (Christiaensen 2017).

Farm incomes per capita depend on per capita land and farm output per hectare. Although rural population density in Africa is still relatively low on average, there are wide variations across SSA, where both high and low-density countries face the challenge of rapid rural population growth more than other areas of the developing world (United Nations 2014). SSA is the only region of the world that is forecasted to have positive rates of growth of the rural population to 2050 (United Nations 2014; Heady and Jayne 2014).

In this context, Africa has been targeted more than any other region of the world by large-scale land acquisitions (LSLA) through foreign direct investments (FDI) but also domestic acquisitions. The wave of FDI, the majority of which has been for agricultural use, has led to fears of "land grabbings".[1] This concern was motivated by several reasons, the most important being that the deals involve at least one crucial asset, land (and also water), usually on a very large scale and predominantly in the context of complex and often unclear structures of property rights.

LSLA and agro-industry investments in Africa are the topics of this chapter. We depart from the focus of most of the "land grabbing literature," which has concentrated on property rights and the risk of dispossession of vulnerable users, to examine whether LSLA may have had a growth impact in the agricultural sector of targeted countries. We first review the literature and general data on the possible transmission channels between LSLA and growth in agriculture. Then, we apply network analysis to analyze the matrixes of land and agro-industry[2] investments to:

- Test whether LSLAs and FDI in food beverages and tobacco (FTB) are positively correlated. If so, we can conclude that if an investor country is buying land in a specific target country in Africa, it will more likely invest also in the agro-industry. This hypothesis, if confirmed, would suggest that land acquisitions could have a developmental impact on the target countries.
- Identify the countries that couple land acquisitions with productive investments.
- Investigate whether there is a process of concentration of investments in specific African countries, by which a few target countries are benefiting more than others from the renewed flows of resources in the continent.

We use two main data sources on investments: Land Matrix,[3] and FDI Markets. The first provides up-to-date information (starting with the year 2000) on large-scale land acquisitions, domestic, and FDI, including the size of contracts (larger than 200 ha, mostly leases). The second provides up-to-date information on greenfield foreign direct investment projects since 2003. Both sources are "private" research projects whose data differ and are more up-to-date than those provided by UNCTAD and OECD. Although the FDI Markets dataset tracks investment in food, beverages, and tobacco (FTB), hence includes primary agricultural production, the latter is a tiny share of the value of FTB.

Hence in this chapter, the FDI Markets dataset is defined as "agro-industry", FDI investments or simply FDI. Land acquisitions reported in the Land Matrix dataset are defined, instead, as large-scale land acquisitions (LSLA).

Policy implications are described in the conclusions.

2 Large-Scale Land Acquisitions and Growth: A Review

Land Balances and LSLA

Land balances worldwide show that a large share of the remaining land suitable for agriculture not already in use (net balance) (Fisher et al. 2011),[4] is concentrated in Africa, and particularly, Sub-Saharan region. Although estimates of area for cropland expansion are very sensitive to the definition of "potentially available" land, there has been basically consensus that in Africa, arable land is relatively abundant (Alexandratos and Bruinsma 2012; Chamberlin et al. 2014; Fischer G. et al. 2011).

Accordingly, the idea of a vast extensive margin for agriculture and egalitarian farm structures has traditionally shaped the development discourse on Africa. The recent revival of the debate on land intensification and the wave of large-scale land acquisitions in the aftermath of the 2007–2008 commodity price boom has however refocused attention on land in Africa and contributed to reshaping the perspective on agrarian structures in the continent (Chamberlin and Headey 2014; Cipollina et al. 2018; Deininger and Byerlee 2011; Jayne et al. 2014).

The available data (Alexandratos and Bruinsma 2012; Fisher et al. 2011; FaoStat; United Nations 2014) show that there is a high degree of heterogeneity among countries in Africa in terms of net land availability and

population pressure on land: (i) The net balances and the largest areas of forests are concentrated in some countries while in others, e.g., Egypt, most land suitable for agriculture is already in use; (ii) The ratio of cultivated to suitable land ranges from 0,9 in Egypt and Rwanda to less than 0.1% in seven countries; (iii) The amount of suitable land per rural inhabitant varies considerably, and about one-third of countries have less than one hectare of land suitable for agriculture for rural inhabitant, largely as a result of demographic trends.

In a synthesis of a debate on the topic of land pressure and farming systems in the region, Jane et al. (2014) emphasized that Africa's surplus land is concentrated within relatively few countries, while many others are land constrained and experiencing declining farm sizes. The authors point out that rapid population growth is taking place amidst declining land endowments in high-density African countries, which are already typified by severe rural poverty.

In this context, Africa has been targeted more than any other region of the world (Fig. 1) by the large scale land acquisitions reported in the last two decades, through FDI but also domestic investments. Figure 1 shows the shares of LSLA (in terms of the number of deals and land acquired in contracts concluded) by world region: Africa accounts for about 40% of deals and land acquired through FDI (international and mixed investments) as reported in Land Matrix across the world.

LSLA distribute unevenly across the African continent. The data on land investments as reported in Land Matrix shows that the highest activity, in

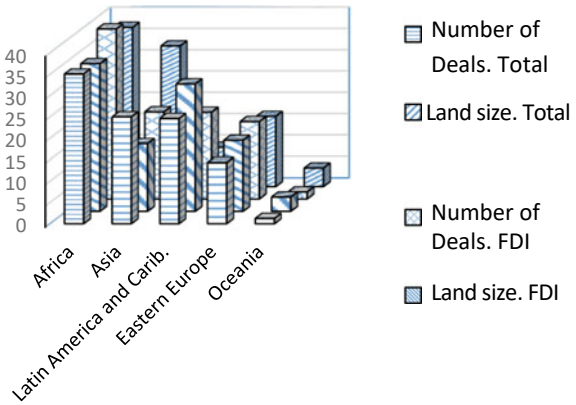

Fig. 1 Shares of total land acquisitions by world region (2020) (*Source* Land Matrix)

terms of the number of deals reported, is in Eastern Africa, followed by Western Africa (Fig. 2a), while the size of land acquired is largest in central followed by Eastern and Western Africa (Fig. 2b).

Figure 3 shows the shares of total deals and total land acquired in Africa by country. In terms of the number of deals, the largest targets are two countries in Eastern Africa: Mozambique, and Ethiopia. The largest areas of land have been acquired in the Democratic Republic of Congo, South Sudan, Mozambique, Congo, and Liberia.

To relate land investments to the size of countries we computed what we refer to as an index of investment (as in Conigliani et al. 2018), namely, the ratio between the overall actual size (ha) of domestic and international and mixed deals (FDI) in a country (concluded, documented by official sources of information, and reported in the Land Matrix dataset), and total agricultural land of the country.

Figure 4 plots the number of international and mixed deals (FDI) by country against the investment index by country. Outliers in this space are countries with many deals and a relatively low investment index (Mozambique and Ethiopia) and countries with the opposite feature, high investment index, and few deals (Liberia and Sierra Leone). In this second group there may have been a limited functioning of land markets, and distinct investors' strategy, with only a few acquisitions of very large size. Therefore, these countries experienced a non-negligible land rush from a relatively limited number of very big investors, which gained control over a substantial portion of territory, with potentially large political, economic, and social consequences.

As mentioned before, the post-2007–2008 wave of land investments, mostly for agricultural use, has been generally discussed in the framework of property rights and the risk of dispossession of vulnerable users. A case studies literature, the so-called "land grabbing" debate (Anseeuw et al. 2012a; Cotula et al. 2009; Cuffaro et al. 2013; FAO 2009; GTZ 2009; Oxfam 2011), has

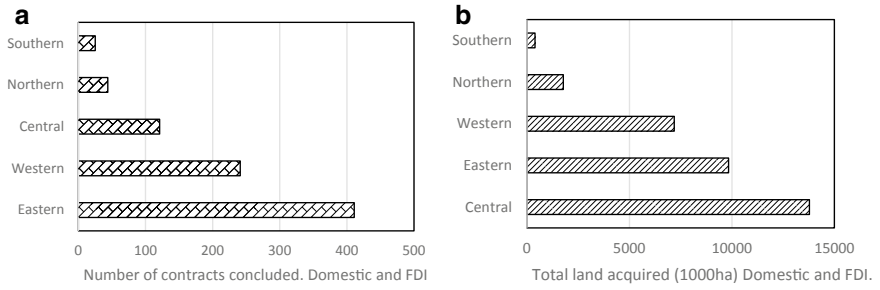

Fig. 2 Africa. Land acquisitions by region (2019) (*Source* Land Matrix)

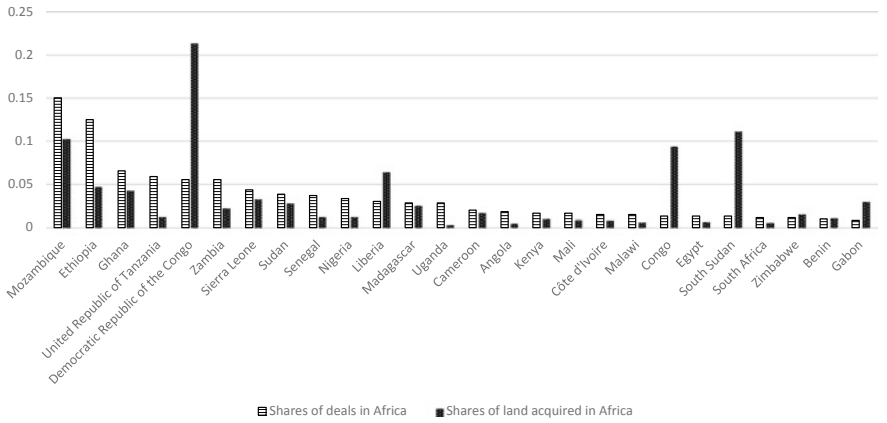

Fig. 3 Africa. Shares of total deal numbers and of land acquired by country (2019) (*Source* Land Matrix)

Fig. 4 Land acquisitions: international investment index vs. number of deals (2019) (*Source* Authors' elaboration Based on Land Matrix and Faostat)

concentrated essentially on deals by international investors targeting developing countries and on the concern that investments are often taking place in contexts where many people have only insecure land rights. Quantitative studies have been comparatively few and have analyzed the determinants of foreigners' land acquisitions in Africa (Deininger and Byerlee 2011; Arezki et al. 2015; Conigliani et al. 2018; Giovannetti and Ticci 2016).

From a different perspective, one may examine the possible links between large-scale acquisitions and growth in agriculture.

LSLA and Growth

In the 1980s and early 1990s case studies across locations in SSA partially formalized and tested a general model of the evolution of farming systems originating in the work of Boserup (1965) and Ruthenberg (1980) (the so-called BR theory or framework), which predicts intensification driven by population growth and market access.[5] An example is Heady and Jane (2014), who, albeit admitting severe data and methodological constraints, conducted cross-country tests of the strength of responses of various land intensification variables (namely, value added, yields, fertilizers use, livestock, and non-land capital per ha) to falling land-labor ratios in Africa and Asia.[6] They found that high population density countries in Africa have largely intensified by increasing cropping intensity, i.e, the ratio of area harvested to cropland (which accounts for half of the growth in total crop output per hectare). However, there was no response of yields to land constraints over the short run and no growth of modern inputs such as fertilizers or irrigation. Intensification hence occurred along an unsustainable path, given the implied mining of nutrients.

A recent World Bank project addresses the issue of data limitation under the Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) Initiative,[7] and researchers using these data have reconsidered some of the key issues of land intensification.

Sheahan and Barrett (2017) find that fertilizer and agro-chemical use in Africa is more widespread than it is often acknowledged, but the incidence of mechanization and irrigation remains quite small. Binswanger and Savastano's (2017) descriptive results show that, consistent with the BR predictions, fallow areas have virtually disappeared under increasing population pressure and market access. However, they also find that, with few exceptions, the proportion of households using chemical fertilizers is too low to maintain or restore the soil nutrients under permanent agriculture. Furthermore, pressure from population growth and market access did not trigger significant irrigation investments.

Land intensification is also dependent on the system of property rights in land, which are notoriously complex in SSA (Cuffaro 2002; Deininger et al. 2011),[8] the traditional view being that factor markets are either missing or imperfectly functioning in the region. Dillon and Barrett (2017), using a range of recent data including LSMS-ISA, show that in the surveyed area

rural factor markets exist (for example, cross-country averages show that, 29.4% of agricultural households rent/borrow land, 38.9% hire labor and 23.7% take out a loan), albeit functioning poorly, as there is a significant link between labor input and household size across all countries. Deininger et al. (2017) analyze land governance constraints to intensification and land market operation and find that differences in land endowments and productivity create the potential for land markets to equalize endowments and contribute to higher levels of productivity; furthermore land rental markets improve equity by promoting land access to those with limited land endowments.

In summary, panel data from the LSMA-ISA household surveys available so far have produced interesting research results; however formal testing of the Boserup-Ruthenberg hypothesis has to wait until data of greater length are available, essentially because changes in farming systems are quite slow (Binswanger and Savastano 2017).

What follows next is a brief review of the literature on the possible transmission channels between LSLA and growth in agriculture, which will lead to the definition of our empirical research focus and approach.

Transmission Channels Between LSLA and Agriculture Growth

There are three possible main transmission channels through which large-scale land investments impact growth in agriculture. First, investors may seek intensification and/or may impact growth through the extensive margin; second, the acquisitions activity may be positively associated with the functioning of land markets, which in turn positively impacts growth; and, third, large farms may capture the advantages of scale-biased participation to modern value chains in agriculture.

On the first channel, the "land grabbing" literature has suggested that recent LSLA have targeted land abundant low productivity countries where land prices are presumably low, and that acquisitions mostly did not result in intensification. The main reasons quoted are two. First, there has been a variety of observed outcomes, including a large incidence of failed projects—often linked to property rights conflicts. Second, because of the much-debated idea that international acquisitions may have been partly driven by motives other than actual production on the part "new" investors, i.e., "financial" and State "political" actors[9] (Anseeuw et al. 2012a; Cotula et al. 2009; FAO 2009; GTZ 2009; Oxfam 2011). Specifically, Arezki et al. (2015) found that the difference between the potential and actual yield on land already cultivated (yield gap), which can be regarded as a predictor of

the ability to quickly increase production through investment, had no consistent impact on acquisitions, while the availability of suitable but uncultivated land for expansion was a key driver of land demand.

Hence, based on the consensus that emerged in the LSLA debate so far, one should observe a negative correlation between average value added per hectare (land productivity) and the share of land acquired in each country; and no correlation between acquisitions and land productivity growth. Indeed, Fig. 5 shows a weak negative correlation between the average productivity of the land by country and the international investment index (after excluding Liberia, which shows an exceptionally high index). Figure 6 shows

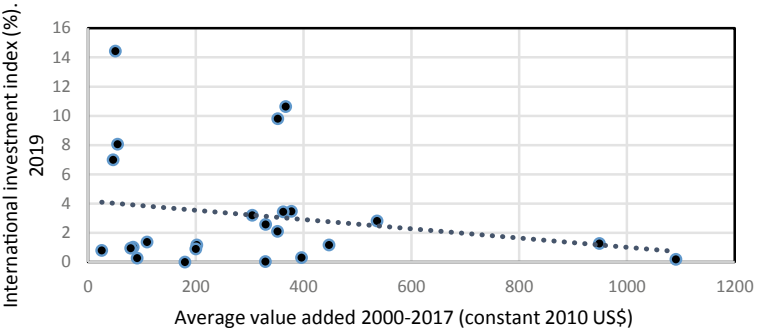

Fig. 5 Africa. Land productivity and international land acquisitions (investment index)[10] (*Sources* Land Matrix and Regional Strategic Analysts and Knowledge Support System [ReSAKSS])

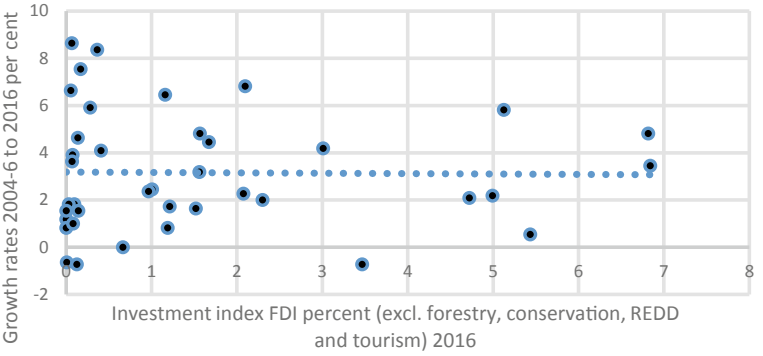

Fig. 6 Africa. International land acquisitions and growth of value added per hectare (*Note* International Investment Index excluding forestry conservation, REDD and tourism. *Sources* Land Matrix and ReSAKSS)

an extremely weak negative correlation between investments and land intensification. These associations seem in line with the idea of resource-seeking investments with no impact on land intensification.

As for the second channel of transmission, the literature suggests that the degree of operation of land markets is positively associated with growth (Besley and Ghatak 2010; Deininger et al. 2017; Chamberlin and Ricker-Gilbert 2016). Indeed, the only significant correlation, positive, in the available data emerges in the relationship between the number of international acquisitions and growth rates of agriculture (Fig. 7), albeit with much dispersion, which may be related to the positive nexus between the existence and functioning of land markets and growth.

Land markets in Africa have been underdeveloped for historical reasons, also linked to the modalities of transition from colonialism to independence (Alden Wiley 2011; Cuffaro 2002). However, there is evidence that these markets are growing with growing population pressure on land, as it should be expected based on the Boserup model and of worldwide empirical evidence (Boserup 1965; Cuffaro 2002). For example, Deininger et al. (2017) analyze evidence on land markets from six Sub-Saharan African countries.[11] They observe that inheritance or grant by traditional authorities or the extended family remains the main way for accessing land and that levels of formal or informal documentation of land ownership remain low throughout—except for Ethiopia. However, their study suggests that land markets are more active and have the potential to contribute to structural transformation more than it has been commonly assumed in the literature on land rights in Africa.

The operation of land markets is in general expected to be positively correlated to land and labor productivity. This is because markets may transfer land to its best and most productive use, and eventually facilitate access to credit markets by using land as collateral. By helping farmers reach economies

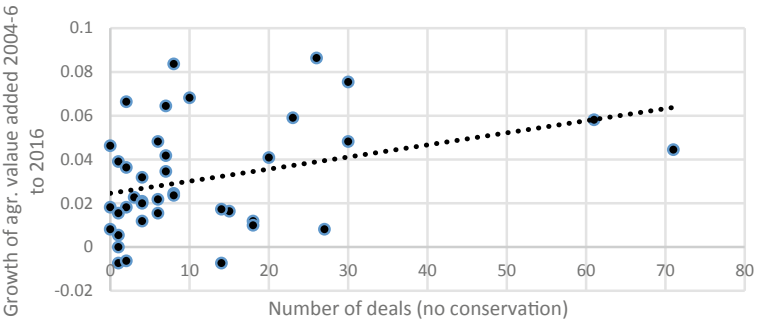

Fig. 7 Africa. Number of international deals and growth rates of agr. value added (2004/6 to 2016) (*Sources* Land Matrix and ReSAKSS)

of scale, efficient land sale, and rental markets can increase farm productivity, raise the incomes of farmers with limited land, and even facilitate the transition to off-farm activities (Deininger et al. 2014).

This leads our discussion to the issue of the scale of farming, which is relevant in the context of large acquisitions, as LSLA are likely to increase the scale of farming. The long-lasting debate on farm size and productivity has provided much empirical evidence on an inverse relationship (IR) (see Rada and Fuglie 2019 for a recent review of this literature) mostly based on data from Asia and Latin America, but it is also confirmed by representative survey data for some countries in Africa (Carletto et al. 2013). If that holds, LSLA possibly resulting in large-scale corporate farming, may not contribute to growth.

The traditional challenges to IR—the most prominent being that land of high quality may be more densely populated because of higher yields, resulting in smaller farms, i.e., farm size endogenously reflects land quality—has been debated with mixed results. However, recent large-scale land acquisitions, which are the topic of this chapter, and other developments such as the emergence of mega-farms in middle-income countries, suggest that new technologies and institutional arrangements may be giving rise to significant farm economies of size, and are new challenges to old IR assumptions (Collier and Dercon 2014; Deininger and Byerlee 2012; Rada and Fuglie 2019). For instance, Foster and Rosenweig (2017) point out that, given the global pattern of farm productivity across developing and developed countries, the relationship between farm productivity and scale is U-shaped, and hold that the existence of labor-market transaction costs can explain why the smallest farms are most efficient, slightly larger farms least efficient and larger farms as efficient as the smallest farms.

Modern value chains in agriculture have been characterized by augmented quality standards of downstream entities (supermarkets and export firms) with procurement systems relying on specialized wholesalers and contract farming. Scale-biased participation tends to arise from scale-variant grower capacity to meet requisite standards, or from scale-invariant contract-related transaction costs, that attenuate the advantages of smallholders (Barrett et al. 2012; Rada and Fuglie 2019; Henderson and Isaak 2017). This is confirmed also by empirical evidence on Africa (e.g., Maertens and Swinnen 2009).

Could large farms capture the advantages of scale-biased participation in modern value chains in agriculture? If that were the case, we should also see a positive correlation between the pattern of land acquisitions and investments in up and downstream activities in agriculture.

The possibility of coexistence between LSLA and agro-industrial investments is particularly appealing. One could expect LSLA to be coupled with downward-linked investments to facilitate the processing, storage, and transportation of agricultural and wood products. This point is also interesting under an economic policy perspective, since the availability of land and the presence of the right mix of country characteristics might facilitate the upgrading of a country's economic system along the global value chains (GVC).

In the next section, we apply network analysis: (i) to test whether LSLA and FDI in food beverages, and tobacco (FTB) are positively correlated. If so, we can conclude that if an investor country is buying land in a specific target country in Africa, it will be more likely also to invest in agro-industry; (ii) to identify which countries have the approach of coupling land acquisitions with manufacturing investments; and (iii) finally, we also want to investigate whether there is a process of concentration of productive investments in specific African countries, by which a few target countries are attracting FDI in agro-industry.

3 The Network of Foreign Acquisitions in Africa: Land and Manufacturing

Network Data

Africa has attracted most of the foreign land acquisitions taking place in the last 20 years. Focusing on the implications of LSLA and their possible linkages with manufacturing and services industries (particularly, focusing on whether they pave the way for more complex and higher value-added forms of investments) is crucial to understanding the possible future scenarios for development. A way to examine such a correlation is to analyze land acquisitions and agro-industry investments as two networks linking African countries to the rest of the world. In the following, the same data used in the previous sections will be analyzed using social network analysis. Table 1 shows

Table 1 Network statistics for the LSLA (2000–2019) and FDI (FTB) (2003–2019) flows

Network statistics	FDI network	LSLA network
# of countries	84	84
# of ties	166	93
Density	0.02	0.013
Average degree	3.95	2.14

the main characteristics for the two networks analyzed: the LSLA showing exchanges of land titles larger than 200 hectares between 2000 and 2019; and the network of FDI Market reporting capital flows in the Food, Beverages, and Tobacco industry (FTB) from the year 2003 to 2019. Overall, there are 85 countries worldwide involved either in LSLAs or FDI in agro-industry, while only 46 countries are present in both networks.

In Fig. 8 LSLA data are presented as a network where a source country "buys land from" a target country in Africa. For example, if the USA buys land from Mozambique (MOZ), in the network an arrow will go from the USA to MOZ. In the figure, the node's size is proportional to in-degree. In social network analysis, the in-degree of a node indicates the sum of all incoming ties a node has (Wasserman and Faust 1994, p. 100). For example, in Fig. 8 Senegal (SEN upper right side of the graph) has in-degree equal to five because there are five incoming ties from other countries to Senegal. In this network ties represent land acquisitions, thus an in-degree equal to five indicates that a total of five land deals were concluded between Senegal and international investors. Of course, in the graph, we can also see precisely which countries acquired land from Senegal. Similarly, Mozambique (MOZ), at the center of the graph in Fig. 8, is particularly large because it has the highest in-degree in the network equal to 11.

Furthermore, the number of hectares acquired in each transaction is depicted in the graph using different line weights. The largest single land

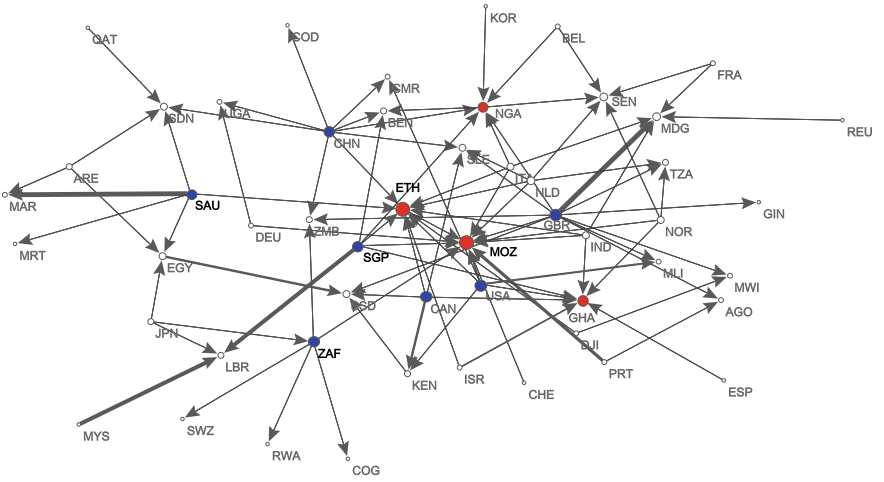

Fig. 8 Large Scale Land Acquisitions (LSLA) network in Africa (*Note* Nodes represent countries; ties represent Large Scale Land Acquisitions. Most central receiver countries are highlighted in red color. Most influential investor countries are highlighted in blue color. *Source* Authors' elaboration based on Land Matrix data)

acquisition recorded in the data occurred between Morocco (MAR) and Saudi Arabia (SAU) for 700,000 hectares.

The network shows that Mozambique (MOZ), Ethiopia (ETH), Ghana (GHA), and Nigeria (NGA) signed the highest number of deals (high in-degree); the largest land sales occurred, instead, in Morocco (MAR), Madagascar (MDG), Liberia (LBR), and Mozambique (MOZ) (tie weights). The buyers involved in these large land acquisitions are (1) ex-colonial powers such as Great Britain (GBR) and Portugal (PRT); (2) Asian tigers such as Singapore (SGP) and Malaysia (MYS) whose strategy was to concentrate their acquisitions mostly in Liberia; and (3) Saudi Arabia (SAU) who bought land primarily in Morocco (MAR).

Figure 9 shows the configuration of the FDI in the food, beverage, and tobacco network in Africa. Similarly, to the LSLAs network, in the FDI network in Fig. 8, nodes represent countries and ties report that a source country "Invested capital in" a recipient country. For example, if Saudi Arabia (SAU) invested capital in the agro-industry sector of Egypt (EGY lower left corner of the graph), an arrow will link SAU to EGY in the network. Ties' width is proportional to the amount of capital invested (Millions). The nodes' size is proportional to in-degree. Therefore, this network in-degree provides

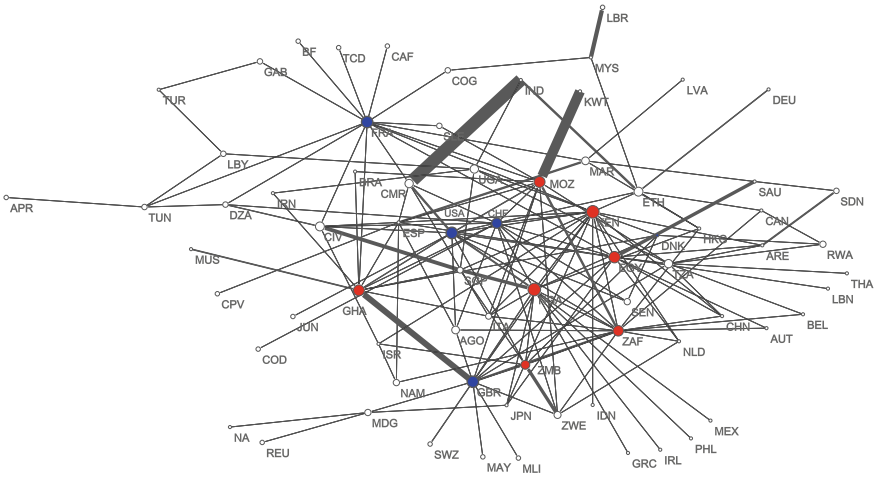

Fig. 9 The network of Foreign Direct Investment (FDI) in the Food, Beverages, and Tobacco industry in Africa (*Note* Nodes represent countries, ties represent Foreign investments in the Food, Beverages, and Tobacco industry (FBT). Most central receiver countries are highlighted in red color and include Nigeria (NGA), Kenya (KEN), Egypt (EGY), Mozambique (MOZ), Ghana (GHA), and South Africa (ZAF). Most influential investor countries are highlighted in blue color and include the USA, Switzerland (CHE), Spain (ESP), France (FRA), and Great Britain (GBR). *Source* Authors' elaboration based on FDI Markets data)

an indication of the capacity of African countries to attract FDI: the higher the in-degree of a country, the higher is the number of countries that decided to invest in it.

The FDI network is denser (0.02 versus 0.01 in the LSLA network) and more articulated than the LSLA network.[12] The largest recipients of FDI in the food, beverage, and tobacco in Africa include, for example, Nigeria (NGA), Kenya (KEN), Egypt (EGY), Mozambique (MOZ), Ghana (GHA), and South Africa (ZAF). France (FRA), Great Britain (GBR), United States (USA), Switzerland (CHE), and Spain (ESP) are the more prominent countries, having invested in more than 10 countries with their companies.

It is also interesting to note that Kuwait (KWT), India (IND), Great Britain (GBR), and Malaysia (MYS) have realized the largest investments in the network. In particular, Malaysia has a unique relationship with Liberia, indicating its willingness not only to buy land but also to make productive investments.

Are LSLAs Correlated to FDI Flows?

As mentioned in the introduction, one of the main questions addressed in this study is whether LSLAs in Africa are correlated with productive FDI in Food, Beverages, and Tobacco. To test this hypothesis, we use a QAP (Quadratic Assignment Procedure) correlation test, which compares the observed correlation between the LSLA and FBT networks against the probability of finding the same correlation by chance in two random graphs with the same characteristics. In practice, this test counts the number of times randomly permuted graphs present the same statistics as those observed in the LSLAs and FDI networks. Thus, similar to the classical significance tests, the higher the *p*-value, the higher the probability to obtain the same correlation by chance on random graphs.

Table 2 reports the results of the QAP correlation test for the LSLAs and FDI networks. In the LSLAs ties' strength is proportional to hectares acquired (Ha); for FDI ties' strength is proportional to the capital invested (Millions).

Table 2 QAP correlation test results for LSLA (200–2019) and FDI networks (2000–2019)

	Observed value	Significance level	Average	Std dev	Minimum	Maximum	# Ob
Pearson correlation	0.1388	0.0043***	0.0001	0.0236	−0.0135	0.6580	49,989

Column 1 reports the observed value of the Pearson correlation coefficient measured on the two networks: in this case, the Pearson correlation coefficient is 0.1388 indicating a moderate positive correlation between the LSLA and the FDI networks. Column 3 reports the average correlation obtained on about 50,000 randomly permuted graphs with the same characteristics of those observed in the empirical networks. The value of this average random correlation is extremely low and equal to 0.001% (column 3, Table 2). Furthermore, the results are highly significant at the 0.01 confidence level (indicated by three asterisks in Table 2, Column 2) meaning that the percentage of random permuted graphs showing the same value or higher of the Pearson coefficient observed in our empirical networks (which is 0.1388) is less than 1 or only 0.43% (column 2, Table 2). Hence, of the 50,000 random permutations, just about 200 networks over 50,000 produced a Pearson coefficient equal or higher to that observed in the empirical data of 0.1388. We can conclude that the observed correlation between the LSLA and the FDI network is not obtained by chance and is highly significant. Thus, the patterns of land acquisitions and productive investments in agriculture is the outcome of a substantive, non-random process. Land acquisitions increase the likelihood of productive FDI by 13% (Pearson correlation coefficient: column 1, Table 2). Similarly, productive investments in agriculture from a foreign country also increase the likelihood of increased land acquisitions by 13%. The correlation, unfortunately, does not provide information about the direction of the relation; however, it suggests that the two processes are related.

To have a clearer visualization of how the two networks overlap, we display only the nodes that are involved in land acquisitions and FDI investments in Fig. 10 (i.e., countries that have bought land at least in one African country and have invested in agro-industry projects in at least one African country). For instance, Great Britain (GBR), the United States (USA), Saudi Arabia (SAU) The Emirates (ARE) have indeed coupled FDIs in the food, beverage, and tobacco industry with LSLAs. By contrast, big players such as France (FRA), Germany (DEU), and China (CHN) do not appear in the graph as they never combined FDIs with land acquisitions.

Mozambique, Ethiopia, Ghana, and Nigeria are the countries that more often attract investments in both land and agro-industry. The special relationship between Liberia and Malaysia that we have observed in the previous sections, is also presented here with a bold solid line coupling of land and FDIs.

The quantitative literature on the determinants of LSLAs has mostly pointed to a resource-seeking motive (Deininger and Byerlee 2011; Arezki

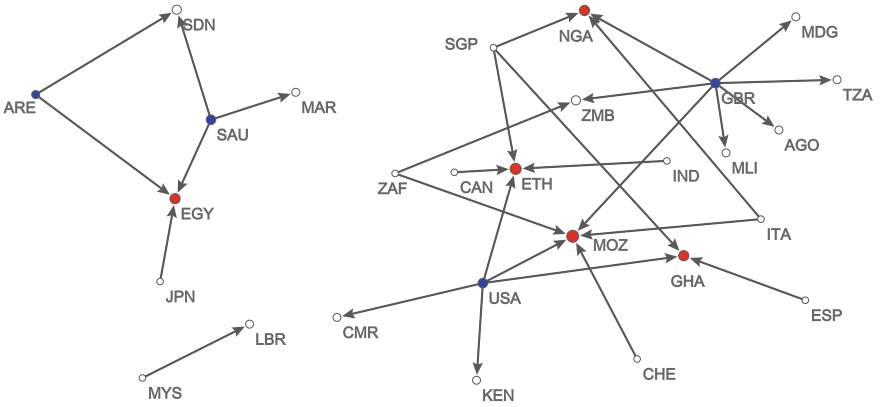

Fig. 10 Multiplex ties in the LSLA and FDI market networks (*Note* Nodes represent countries, ties are present when both land acquisitions and FDI occur together. *Source* Authors' elaboration based on the Land Matrix and FDI market data)

et al. 2015; Conigliani et al. 2018; Giovannetti and Ticci 2016). A recent study by Arezki et al. (2018) holds that LSLAs are more likely motivated by re-exports to investor countries, i.e., they are functional to integrated food chains driven by investors' food security. Our analysis adds to this literature by suggesting that investors' strategies are indeed diversified and may also be coupled with agro-industry investments.

In the section that follows, a community detection algorithm is used to explore in more detail the characteristics of each network and to understand whether a higher correlation exists between groups of countries investing in specific regions of Africa.

Exploring the Regional Patterns of LSLA and FDI in Africa Through Community Detection

Structural Patterns in the Network of LSLAs

The network of LSLAs in Africa is analyzed using a community detection algorithm[13] (Blondel et al. 2008) to identify groups of countries with similar patterns of land sales. The algorithm aims at clustering countries into groups that are more densely related to one another. In Fig. 11 the results of the community detection analysis are presented. The network analyzed is the same as in Fig. 8, however, in this visualization nodes belonging to the same community are closer. Moreover, we ordered countries in each community

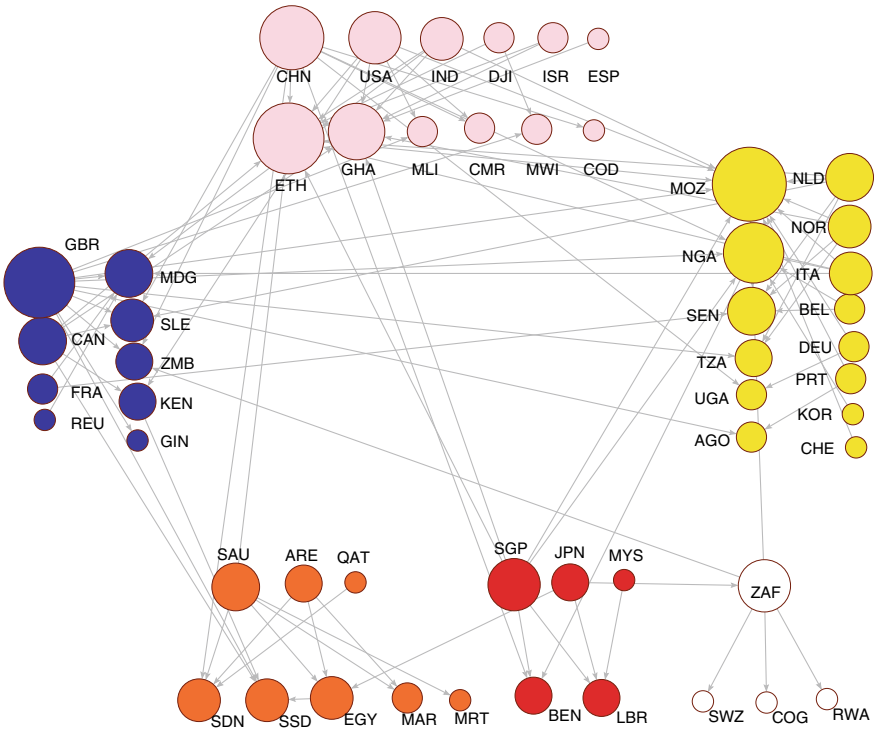

Fig. 11 Louvain Communities in the LSLAs network (2000–2019) (*Note* Nodes represent countries and ties represent LSLAs. Nodes' colors indicate Louvain communities of countries. *Source* Authors' elaboration based on the Land Matrix)

by network degree centrality so that nodes with a higher number of connections are at the top and those with fewer ties are at the bottom of each group. Furthermore, we created two columns for each community, one with all land buyers and the other with land sellers. Nodes' color indicates communities, thus if two countries have the same color, it means they belong to the same community insofar as they buy land from a similar set of African countries. Node size is proportional to nodal degree measuring the number of contracts each country has concluded.

It is possible to see from the graph that investments in large land acquisitions in Africa follow a very clear geographical pattern: each community includes buyers from the same world region. Community 1, colored in yellow, includes many investors from Europe such as Italy (IT), the Netherlands (NDL), Belgium (BEL), Norway (NOR), Portugal (PRT), and Germany (DEU). This European group mostly acquires land from Mozambique (MOZ), Nigeria (NGS), Senegal (SEN).

Community 2, colored in blue on the left side of the graph, includes France and Great Britain which are the most influential ex-colonial powers in the continent. Madagascar (MDG), Sierra Leone (SLE), and Zimbabwe (ZIM) are the African countries that are the most targeted in this group. It is important to recall here that Great Britain and France have, however, very different investment strategies. The former has a tendency to couple land acquisitions with productive investments in the Food, Beverages, and Tobacco industry; while the latter, which mostly invest in Madagascar, uses a decoupling strategy.

Community 3, colored in pink, includes all new investors interested in Africa such as the USA, China (CHN), and India (IND). These new powers are investing mostly in Ethiopia (ETH), Ghana (GHA), and Mali (MLI). Among these foreign investors, only the USA tends to join FDI and LSLAs.

Community 4, colored in orange, mostly includes investors from the Middle East such as The Emirates (ARE), Saudi Arabia (SAU), Qatar (QAT). From the African side, in this group, we find Sudan (SDN), South Sudan (SSD), and Egypt (EGY).

Furthermore, community 5, colored in red, includes land buyers from Asia. In particular, we can find in this community; Singapore (SGP), Japan (JPN), and Malaysia (MYS). It is interesting to notice that Asian investors concentrate specifically on Liberia (LBR) and Benin (BEN), except for Singapore whose land acquisitions span across Ghana and Ethiopia (GHA an ETH, pink community) Mozambique and Nigeria (MOZ and NGA, Yellow community).

Finally, South Africa (ZAF) dominates community six colored in white. Land acquired by South Africa comes from Rwanda (RWA), Congo (COG), and Swaziland (SWZ). The countries in this sixtieth community have all exclusive ties with South Africa.

Overall, it is possible to notice that the three communities on the top (Yellow, Pink, and Blue) are quite well integrated because there are many ties linking countries across communities. In particular, the most central African countries in these three groups are targets of land acquisitions from investors in the other groups. Overall, land acquisitions concentrate mostly in Mozambique, Madagascar, Ethiopia, and Ghana.

By contrast, the communities at the bottom of the graph (white, orange, and red) are relatively narrow, with few crosscutting ties to one another. The extreme case being South Africa (ZAF), which represents an exclusive partner for Congo, Rwanda, and Swaziland. South Africa is thus the only country that is buying land in central Africa.

In conclusion, the community detection algorithm highlighted a new geography of land acquisitions in Africa, with six distinct communities each representing a distinct world region: formal colonial empires such as Great Britain and France; other European countries, new global economies such as China, India, USA, and Israel; the Middle East, Asia and, finally South Africa.

In the next section, the same algorithm for community detection is used to partition the FDI matrix and to understand to what extent this geography of land acquisition holds when capital is considered.

Structural Patterns in FDI Networks in Africa

What follows is a discussion of the geographical distribution of FDI in Food, Beverages, and Tobacco (hereafter referred to as the agro-industry). As for the LSLA network, Louvain community detection algorithm has been used to partition the FDI network into groups of densely connected countries. The ties in this network indicate that a country "invested capital in" another country measured in millions of dollars.

Figure 12 shows the result of the analysis. The network presented in Fig. 12 is the same network presented in Fig. 9, however, in this visualization nodes'

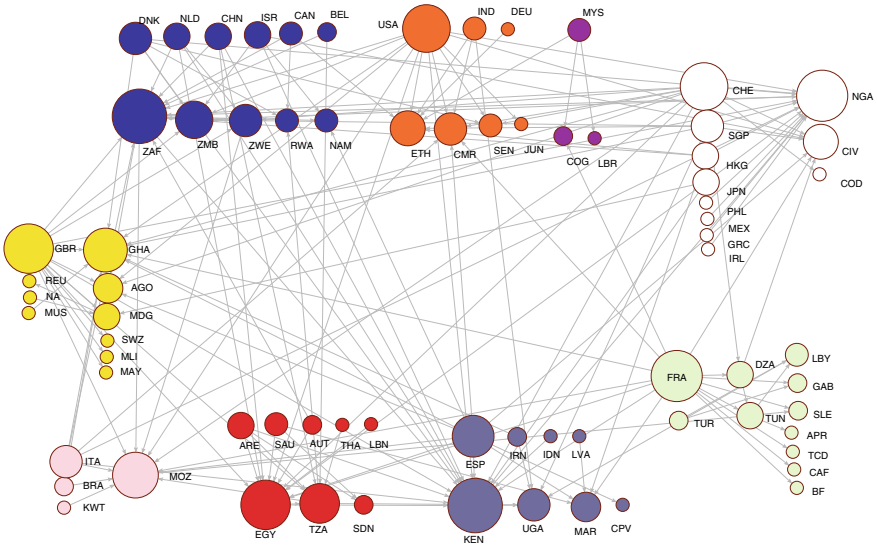

Fig. 12 Louvain Communities in the FDI network (2003–2019) (*Note* Nodes represent countries and ties represent FDI. Nodes' colors indicate Louvain communities of countries. *Source* Authors' elaboration based on the FDI Markets data)

color indicates Louvain communities. Furthermore, nodes belonging to the same communities are closer to each other. Finally, node size is proportional to the degree measuring the number of investments done and received by each country. As for the LSLAs network, also, in this case, nodes were rearranged to differentiate investors from target countries.

The communities identified in the FDI network are very different from those characterizing the LSLA network. The eight communities identified in the FDI network do not follow a clear geographical pattern as those identified in the LSLA network. By contrast, in the FDI network communities involve investors coming from a variety of different geographical areas.

It is interesting to notice that most communities in this network are dominated by the presence of a few prominent target countries. These African countries are the most attractive for FDIs in the Food, Beverages, and Tobacco sector as the large nodes representing South Africa (Blue), Ethiopia, and Cameroon (Orange), Nigeria (White), Kenya, and Uganda (Dark Blue); Egypt (Red); Mozambique and Ghana (Yellow). These prominent countries not only attract investments from the foreign countries within their community, but also from investors clustered in other communities, showing a generalized tendency to attract FDI from all investors in the network. This is probably because business conditions are overall better in these countries. From the investor point of view, Great Britain, France, the USA, and Switzerland are the four major players in this network, spreading their ties across most communities.

These results suggest that there exists a core of countries that are the most active in sending and receiving FDI in Africa. To identify these core actors, we use the K-core algorithm (Batagelj and Zaversnik 2003). The network in Fig. 13 presents the result of a K-core analysis of the FDI network. In the graph, central actors in the core are highlighted in black. This cohesive group of actors includes not only the most central actors but also the ones that have a higher number of links among themselves. In this group, we can find South Africa, Egypt, Kenya, Cameroon, Mozambique, Zimbabwe, Ghana, Nigeria as well as Great Britain, France, USA, Italy, and Switzerland.

On the opposite extreme, on the outskirt of the networks is the periphery where we find the countries with fewer connections (grey). The countries in the periphery are those that completely depend on a single investor. This is, for instance, the case of Mali (MLI), Malawi (MAY), and Swaziland (SWZ), Liberia (LBR), or South Sudan (SDN). In this periphery, we also find investor countries that are concentrating their resources only in one or a few African countries. For instance, this is the case of Germany (DEU), Turkey (TUR), and Thailand (THA).

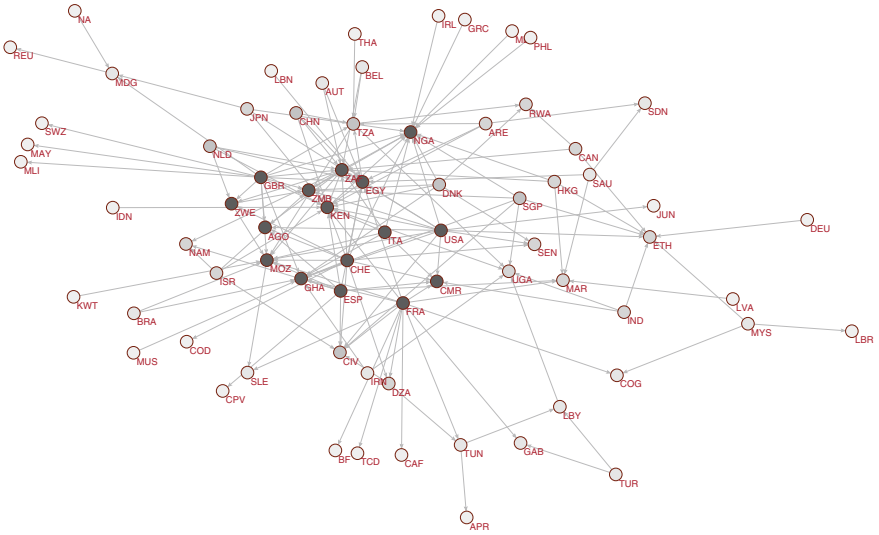

Fig. 13 K-core groups in the FDI network (2003–2019) (*Note* Nodes represent countries and ties represent FDI. Color intensity indicates core actors in the network. *Source* Authors' elaboration based on the FDI Markets data)

In between the core and the periphery, there is a semi-periphery (grey). Here we find China, Denmark, Switzerland, which are investing in Cote D'Ivoire (CIV) and Tanzania (TZA). India, Japan and Israle that are investing in east-central Africa including Ethiopia, Uganda and Rwanda.

4 Conclusions

In this chapter, we use social network analysis to examine large-scale land acquisitions (LSLA) in Africa and FDI in the Food, Beverages, and Tobacco industry (FDI) to understand to what extent they are correlated and what impact they have on growth.

We first review the geographic pattern of land investments across the continent and the transmission channels between LSLA and growth. There are three possible main transmission channels between LSLA and growth in agriculture: investors may seek intensification or may use the extensive margin; the acquisitions activity may be positively associated with the functioning of land markets, which in turn positively impacts growth; large farms may capture the advantages of scale-biased participation to modern value chains in

agriculture. The possibility that foreign acquisitions of land could be associated with FDI in agro-industry emerges from our discussion as an innovative research question.

We apply network analysis to examine foreign direct investments in land and the agri-food industry (Food, Beverages, and Tobacco) to test whether they are correlated; which investor countries do couple land acquisitions with agro-industry investments; whether there is a process of concentration of FDI flows in specific target African countries.

Results show that there exists a moderate and significant positive correlation overall between the pattern of land acquisitions and investments in the Food, Beverages, and Tobacco industry. This correlation has been overlooked in the "land grabbing" debate.

However, we also found that investor countries do have different strategies. Only a few countries systematically associate investments in the FDI industry with LSLA in Africa, namely, the USA, Saudi Arabia, and Great Britain. The centrality of these countries increases the overall correlation between the two networks. Most other countries, by contrast, adopt a decoupling strategy because their productive FDI in agro-industry does not occur in the same African countries where they made LSLA. This is, for instance, the case of countries such as France and China, that never associate FDI and LSLA investments. France and China are also very central actors in both the networks analyzed, and this explains why the correlation between the two matrixes is very weak.

Looking at receiving countries, only a few countries in Africa can attract both agro-industrial investments and LSLA, namely, Mozambique, Ethiopia, Ghana, and Nigeria. For other countries, the ability to attract FDI or LSLA varies greatly. A specific algorithm to identify the most central and interconnected countries (the k-cores analysis) showed that the agro-industry network has a core-periphery structure where a set of central target countries receive FDI by most investors, while peripheral countries only depend from one or two investor countries.

For land markets, our analysis identified a distinct geography of acquisitions in Africa through a "community detection algorithm" that identifies groups of countries with similar patterns of acquisitions. A six groups partition in our analysis captures deep-seated influences on Africa such as those exerted by France and Great Britain. It also identifies new players such as the USA, China, and India; other European countries; East Asian countries (Japan, Malaysia, and Singapore); the Middle East led by Saudi Arabia; and finally a group dominated by South Africa mostly investing in central African states.

Agro-industry capital flows in Africa follow a different pattern that is unrelated to that leading to land acquisitions. At the core of the FDI network, we find more dynamic African countries such as South Africa, Egypt, Kenya, Cameroon, Mozambique, Zimbabwe, Ghana, Nigeria. At the periphery, there are countries whose development mostly depends on one or a few specific investors. This is for instance the case of Liberia or South Sudan.

Although there are positive links between land acquisitions and agro-industrial investments, the factors that make a country attractive for land investments are not necessarily the same that determine the ability to attract manufacturing food processing. Indeed, African countries have a considerable advantage in attracting land investments but many of them may lack the conditions for effectively attracting investments for the subsequent productive phases.

Agriculture in Africa has not been sufficiently linked to agro-industries, and increasing private sector investment in this sector is a development objective (FAO-UNIDO 2010; UNDP 2018). International demand for "land" is increasing and governments in Africa are often involved in the negotiations of large scale land acquisitions (Cotula 2020). Therefore, we believe that a useful policy indication for the land acquisitions debate is that governments could require from investors effective coupling strategies between land and manufacturing investments, and on their part, they should have credible policies for enabling such strategies.

Notes

1. The phenomenon of LSLAs emerged mainly since the 2007–2008 commodity price boom through media reports; since timely and reliable data on investment in agriculture and land were not available and hard to find for several reasons. First, investments that do not go through multinational enterprises (MNEs) are difficult to trace, and in the case of agriculture, there are many new non-MNEs actors, often private equity or State-owned funds, sometimes specifically established for investing in land acquisitions (UNCTAD 2009). Second, a recent trend, such as land grabbing, may not be reflected in FDI data for a substantial length of time because a transaction appears in FDI data only when it has been fully paid (UNCTAD 2009). Other limitations include deals not being reported if host governments see them as politically sensitive and existing reports and databases having very different coverage.
2. Throughout this chapter we use the term agro-industry for industrial processing activities linked to the manufacturing of food products, beverages, and tobacco (FAO-UNIDO 2015).

3. International Land Coalition in partnership with several research centers (CDE, CIRAC, GIZ, GIGA) has published Land Matrix (Anseeuw et al. 2012b and http://landportal.info/landmatrix). Land Matrix includes deals (purchase, lease, or concession), at a different stage of negotiation (intended, concluded, failed); transnational and domestic, initiated since the year 2000, and covering an area of 200 hectares or more.
4. The regional data for land availability are evaluated at the world level in the Global Agro-Ecological Zones (GAEZ) project (Fischer et al. 2011). This assessment provides estimates of six suitability classes condensed into three: prime land, good land, and marginal and not suitable land. "Suitable land" is the sum of "prime" and "good" land. "Gross balance" is suitable land minus cultivated. "Net balance" is suitable land minus cultivated, forest, built, and protected. The idea of "land availability" refers to the notion of net-balance.
5. In Boserup, growing pressure on land implies increased use of labor with associated diminishing returns until, eventually, a new, superior technique is introduced. Yields per acre increase, but output per hour worked may decline or stagnate. Boserup's horizon is very broad, describing a sequence in which land-use systems and techniques evolve in response to increasing population pressure (Cuffaro 1997, 2002).
6. The authors regress the first difference of the log of various intensification variables against the log of the first difference of agricultural population density, separately for Asian and African samples.
7. The Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) Initiative http://surveys.worldbank.org/lsms/integrated-surveys-agriculture-ISA collects households surveys panel data (over the period 2008–2020) through, nationally representative surveys in eight African countries, representing 45% of Sub-Saharan Africa's (SSA) population.
8. The Land Governance Assessment Framework compares countries' land situation in five areas (land rights recognition, land use planning, management and taxation, expropriation, public provision of land information, and conflict resolution) against global good practice via an ordinal ranking of some 80 dimensions that draws on input by local experts and stakeholders (Deininger et al. 2011).
9. Agribusiness has accounted the largest share of investors in land acquisitions but governments, sovereign wealth funds (SWFs) and private sector finance have been increasingly involved. For example, international pension funds have been expanding and diversifying their portfolios to include more developing world agriculture exposure.
10. Data of the Regional Strategic Analysts and Knowledge Support System (ReSAAKS) are compiled for tracking implementation of the Comprehensive Africa Agriculture Development Programme (CAADP).
11. Data from LSMS-ISA surveys in Ethiopia, Malawi, Niger, Nigeria, Tanzania, and Uganda.

12. Network density is equal to the number of lines present in the observed graph divided by the maximum possible lines the graph could have if fully connected. Formally, density = $2L/g(g-1)$ were L is the number of lines observed and g is the number of nodes in the graph.
13. Louvain community embedded in Pajek software for network analysis. To optimize results, the Louvain algorithm was run on the network with no isolate nodes and a resolution parameter of 0.5 and 10,000 repetitions.
14. The phenomenon of LSLAs emerged mainly since the 2007–2008 commodity price boom through media reports. since timely and reliable data on investment in agriculture and land were not available and hard to find for several reasons. First, investments that do not go through multinational enterprises (MNEs) are difficult to trace, and in the case of agriculture, there are many new non-MNEs actors, often private equity or State-owned funds, sometimes specifically established for investing in the land (UNCTAD 2009). Second, a recent trend, such as land grabbing, may not be reflected in FDI data for a substantial length of time because a transaction appears in FDI data only when it has been fully paid (UNCTAD 2009). Other limitations include deals not being reported if host governments see them as politically sensitive and existing reports and databases having very different coverage.

Bibliography

African Development Bank. *African Economic Outlook 2018*. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/African_Economic_Outlook_2018_-_EN.pdf.

Alden Wily, Liz. "'The Law Is to Blame': The Vulnerable Status of Common Property Rights in Sub-Saharan Africa". *Development and Change* 2011, 42(3): 733–757. https://doi.org/10.1111/j.1467-7660.2011.01712.

Alexandratos, Nikos, and Jelle Bruinsma. World agriculture towards 2030/2050: The 2012 revision. ESA Working 12-03. Rome, FAO, 2012.

Anseeuw, Ward, Liz Alden Wily, Lorenzo Cotula, and Michael Taylor. *Land Rights and the Rush for Land: Findings of the Global Commercial Pressures on Land Research Project*, ILC, Rome, 2012a.

Anseeuw, Ward, Mathieu Boche, Thomas Breu, Marcus Giger, Jann Lay, Peter Messerli, and Kerstin Nolte. *Transnational Land Deals for Agriculture in the Global South. Analytical Report Based on the Land Matrix Database*, CDE/CIRAD/GIGA, Bern/Montpellier/Hamburg, 2012b.

Arezki, Rabah, Christian Bogmans, and Harris Selod. *The Globalization of Farmland Theory and Empirical Evidence*. World Bank, 2018.

Arezki, Rabah, Klaus Deininger, and Harris Selod. "What Drives the Global Land Rush?" *World Bank Economic Review* 2015, 29(2): 207–233. https://doi.org/10.1093/wber/lht034.

Bah, El-hadj M., Carlos Conde, Attilio Di Battista, Margareta Drzeniek Hanouz, Caroline Galvan , Philipp Heinrigs, Barak Daniel Hoffman, Jonathan Mckenna, Jennifer Moyo, Anthony O'Sullivan, Juan Sebastian Saez , John Speakman, and Audry Verdier-Chouchane. *The Africa Competitiveness Report* 2015. Washington, DC: World Bank. http://documents.worldbank.org/curated/en/2015/06/24583915/africa-competitiveness-report-2015.

Barrett, Christopher B., Luc Christiaensen, Megan Sheahan, Abebe Shimeles. *On the Structural Transformation of Rural Africa*. Policy Research Working Paper No. 7938. World Bank, Washington, 2017.

Barrett, Christopher, Maren E. Bachke, Marc F. Bellemare, Hope C. Michelson, Sudha Narayanan, and Thomas F. Walker. "Smallholder Participation in Contract Farming: Comparative Evidence from Five Countries". *World Development* 2012, 40(4): 715–730.

Batagelj, Vladimir, Matjaz Zaversnik. *An O (m) Algorithm for Cores Decomposition of Networks*. arXiv preprint https://arxiv.org/abs/cs/0310049, 2003.

Besley, Thimothy, and Maitreesh Ghatak. "Property Rights and Economic Development". In Dani Rodrik and Mark Rosenzweig, editors: *Handbook of Development Economics*, Vol. 5. The Netherlands: North-Holland, 2010.

Binswanger-Mkhize, Hans, and Sara Savastano. "Agricultural Intensification: The Status in Six African Countries". *Food Policy* 2017, 67: 26–24.

Blondel, Vincent, Jean-Loup Guillaume, Renaud Lambiotte, and Etienne Lefebvre. "Fast Unfolding of Communities in Large Networks". *Journal of Statistical Mechanics: Theory and Experiment*, 2008 (10).

Boserup, Ester. *The Conditions of Agricultural Growth.* Chicago: Aldine, 1965.

Calogero Carletto, Sara Savastano and Alberto ZezzaCarletto, "Fact or Artifact: The Impact of Measurement Errors on the Farm Size Productivity Relationship". *Journal of Development Economics* 2013, 103: 254–261.

Cotula, Lorenzo, Sonja Vermeulen, Rebeca Leonard and James Keeley, Land Grab or Development Opportunity? Agricultural Investment and International Land Deals in Africa, FAO, IIED and IFAD, 2009.

Cuffaro, Nadia, Giorgia Giovannetti, and Salvatore Monni, "Foreign Acquisitions of Land in Developing Countries. Risks, Opportunities and New Actors", QA-Rivista dell'Associazione Rossi-Doria n. 2, 2013.

Chamberlin, Jordan, and Jacob Ricker-Gilbert. "Participation in Rural Land Rental Markets in Sub-Saharan Africa: Who Benefits and by How Much? Evidence from Malawi and Zambia". *American Journal of Agricultural Economics* 2016, 98(5): 1507–1528.

Chamberlin Jordan, Jayne, Thomas, and Derek Headey. Scarcity amid Abundance? Reassessing the potential for cropland expansion in Africa. *Food Policy* 2014, 48: 51–65.

Christiaensen, Luc. "Agriculture in Africa—Telling Myths from Facts: A Synthesis". *Food Policy* 2017, 67: 1–11.

Cipollina, Maria, Nadia Cuffaro, and Giovanna D'Agostino. "Land Inequality and Economic Growth: A Metanalysis". *Sustainability* 2018, 10(12): 4655. https://doi.org/10.3390/su10124655.

Collier, Paul, and Stefan Dercon. "African Agriculture in 50 Years: Smallholders in a Rapidly Changing World? "*World Development* 2014, 63: 92–101.

Conigliani, Caterina, Nadia Cuffaro, and Giovanna D'Agostino. "Large-Scale Land Investments and Forests in Africa". *Land Use Policy*, Elsevier, Volume 75, 2018, Pages 651–660. ISSN 0264-8377. https://doi.org/10.1016/j.landusepol.2018.02.005. http://www.sciencedirect.com/science/article/pii/S0264837717301308.

Cotula, Lorenzo. 2020. https://www.iied.org/understanding-growing-pressures-land-land-grabbing-beyond.

Cuffaro, Nadia. "Population Growth and Agriculture in Poor Countries: A Review of Theoretical Issues and Empirical Evidence", *World Development* 1997, 25(7): 1151–1163.

Cuffaro, Nadia. *Population, Economic Growth and Agriculture in Less Developed Countries*. London and New York: Routledge, 2002.

Davis, Benjamin, Stefania Di Giuseppe, Alberto Zezza. "Are African Households (Not) Leaving Agriculture? Patterns of Households' Income Sources in Rural Sub-Saharan Africa". *Food Policy* 2017, 67: 153–174.

Deininger Klaus, and Derek Byerlee, Rising Global Interest in Farmland: Can It Yield Sustainable and Equitable Benefits?, World Bank, Washington, 2011.

Deininger, Klaus, and Derek Byerlee. "The Rise of Large Farms in Land Abundant Countries: Do They Have a Future? *World Development* 2012, 40: 701–714.

Deininger, Klaus, Harris Selod, and Anthony Burns. *Improving Governance of Land and Associated Natural Resources: The Land Governance Assessment Framework*. World Bank, 2011.

Deininger, Klaus, Sara Savastano, and Fang Xia. "Smallholders' Land Access in Sub-Saharan Africa: A New Landscape?" *Food Policy* 2017, 67: 78–92.

Deininger, Klaus, Thea Hilhorst, and Vera Songwe. "Identifying and Addressing Land Governance Constraints to Support Intensification and Land Market Operation: Evidence from 10 African Countries". *Food Policy*, October 2014, 48: 76–87.

Dillon, Brian, and Christopher Barrett. Agricultural Factor Markets in Sub-Saharan Africa: An Updated View with Formal Tests for Market Failure". *Food Policy* 2017, 67: 64–77.

FAO. *The State of Food and Agriculture.* http://www.fao.org/state-of-food-agriculture/2017.

FAO-UNID. *African Agribusiness and Agro-Industries Development Initiative*, 2010. http://www.fao.org/3/i1587e/i1587e00.pdf.

FAO-UNIDO. FAO-UNIDO Expert Group Meeting on Agro-Industry Measurement (AIM) Report 23–24 November 2015, Rome, Italy. http://www.fao.org/fileadmin/templates/ess/documents/meetings_and_workshops/faounido/Report_AIM_EGM_November2015.pdf.

Fiedler, Yannick, and Massimo Iafrate. *Trends in Foreign Direct Investment in Food, Beverages and Tobacco*. FAO, 2016.

Fischer, Günther, Freddy O. Nachtergaele, and Harrij van Velthuizen. *GAEZ v3.0–Global Agro-ecological Zones Model Documentation* (mimeo). IIASA, Luxemburg, 2011. http://www.iiasa.ac.at/Research/LUC/GAEZv3.0/gaez2010-Flyer_1final1.pdf.

Foster, Andrew D., and Mark R. Rosenzweig. "Are There Too Many Farms in the World? Labormarket Transaction Costs, Machine Capacities and Optimal Farm Size". *NBER Working* Paper No. 23909. National Bureau of Economic Research, Cambridge, 2017.

GAEZ Gobal Agro-Ecological Zones http://www.fao.org/nr/gaez/en/.

Giovannetti, Giorgia, Elisa Ticci. "Determinants of Biofuel-Oriented Land Acquisitions in Sub-Saharan Africa". *Renewable Sustain: Energy Reviews*. Elsevier 2016, 54(C), 678–687.

GTZ. *Foreign Direct Investment (FDI) in Land in Developing Countries*; Deutsche GesellschaftfürTechnischeZusammenarbeit: Bonn, Germany, 2009. 81.

Heath, Henderson, and Alan G. Isaac. "Modern Value Chains and the Organization of Agrarian Production". *American Journal of Agricultural Economics*, March 2017, 99(2): 379–400. https://doi.org/10.1093/ajae/aaw092.

Holden, Stein T., and Keijiro Otsuka. "The Roles of Land Tenure Reforms and Land Markets in the Context of Population Growth and Land Use Intensification in Africa". *Food Policy* 2014, 48: 88–97. https://doi.org/10.1016/j.foodpol.2014.03.005.

Jayne Thomas, Chamberlin, Jordan, and Derek Headey. "Land Pressures, the Evolution of Farming Systems, and Development Strategies in Africa: A Synthesis". *Food Policy* 2014, 48: 1–17. https://doi.org/10.1016/j.foodpol.2014.05.014.

Jayne, Thomas, and Derek Headey. "Adaptation to Land Constraints: Is Africa Different?" *Food Policy* 2014, 48: 18–33. https://doi.org/10.1016/j.foodpol.2014.05.005.

Jayne, Thomas, Jordan Chamberlin, and Derek Headey. "Scarcity Amid Abundance? Reassessing the Potential for Cropland Expansion in Africa". *Food Policy* 2014a, 48: 51–65.

Jayne, Thomas S., Jordan Chamberlin, and Derek D. Headey, "Land Pressures, the Evolution of Farming Systems, and Development Strategies in Africa: A Synthesis". *Food Policy* 2014b, 48: 1–17. https://doi.org/10.1016/j.foodpol.2014.05.014.

Jayne, Thomas S., Jordan Chamberlin, Lulama Traub, Nicholas Sitko, Milu Muyanga, Felix K. Yeboah, Ward Anseeuw, Antony Chapoto, Ayala Wineman, Chewe Nkonde, and Richard KachuleJayne. "Africa's Changing Farm Size Distribution Patterns: The Rise of Medium-Scale Farms". *Agricultural Economics* 2016, 47: 197–214.

Land Matrix. https://landmatrix.org/.

Maertens, Miet, and Johan Swinnen. "Trade, Standards, and Poverty: Evidence from Senegal". *World Development* 2009, 37(1): 161–178.

Otsuka, Keijiro, Yanvan Liu, and Futoshi Yamauchi. Growing Advantage of Large Farms in Asia and Its Implications for Global Food Security. *Global Food Security* 2016. https://doi.org/10.1016/j.gfs.2016.03.001i.

Oxfam. *Land and Power: The Growing Scandal Surrounding the New Wave of Investment in Land*, 2011. www.oxfam.org/grow (accessed on 15 April 2013), 82.

Rada, Nicholas E., and Keith Fuglie. "New Perspectives on Farm Size and Productivity". *Food Policy* 2019, 84: 147–152.

Reardon, Thomas, Christopher Barrett, Julio Berdegue, and Johan Swinnen. "Agrifood Industry Transformation and Small Farmers in Developing Countries." *World Development* 2009 37(11): 1717–1727.

ReSAKSS. https://www.resakss.org/.

Ruthenberg, Hans P. *Farming Systems in the Tropics*. Oxford: Clarendon Press, 1980.

Sheahan, Megan, and Christopher Barrett. "Ten Striking Facts About Agricultural Input Use in Sub-Saharan Africa". *Food Policy* 2017, 67: 12–25.

UNCTAD. *World Investment Report*. Geneva, 2009.

UNDP. http://www.africa.undp.org/content/rba/en/home/blog/2018/addressing-the-foreign-direct-investment-paradox-in-africa.html.

United Nations. Department of Economic and Social Affairs, Population Division. In World Urbanization Prospects: The 2014 Revision; 2014. Available online: https://esa.un.org/unpd/wup/publications/files/wup2014-report.pdf (accessed on 14 June 2016).

Wasserman, Stanley, and Katherine Faust. *Social Network Analysis: Methods and Applications* (Vol. 8). Cambridge: Cambridge University Press, 1994.