What Drives the Global "Land Rush"?

Rabah Arezki, Klaus Deininger, and Harris Selod

We review evidence regarding the size and evolution of the "land rush" in the wake of the 2007–8 boom in agricultural commodity prices, and we study the determinants of foreign land acquisition for large-scale agricultural investment. The use of data on bilateral investment relationships to estimate gravity models of transnational land-intensive investments confirms the central role of agro-ecological potential as a pull factor. However, this finding contrasts the standard literature insofar as the quality of the destination country's business climate is insignificant, and weak tenure security is associated with increased interest for investors to acquire land in the country. Policy implications are discussed. JEL codes: F21, O13, Q15, Q34

After decades of stagnant or declining commodity prices when agriculture was considered a "sunset industry", recent increases in the level and volatility of commodity prices and a concomitant rise in the global demand for land have taken many observers by surprise. Anticipation of future commodity price spikes and a lack of alternative assets for investments during the 2008 financial crisis led to marked increases in the demand for agricultural land. Reactions to this phenomenon have been mixed. Some, including many host-country governments, welcome it as an opportunity to overcome decades of under-investment in the

Rabah Arezki is a Senior Economist with the Research Department of the International Monetary Fund, and a non-resident fellow with the Brookings Institution; his email address is rarezki@imf.org. Klaus Deininger is a Lead Economist with the Development Research Group of the World Bank; his email address is kdeininger@worldbank.org. Harris Selod is a Senior Economist with the Development Research Group of the World Bank, and a CEPR affiliate; his email address is hselod@worldbank.org. The authors thank Raphael Alomar and David Cousquer for making their historical data available to us for free, Charlotte Coutand and Caroline Silverman for help with data coding, Sudhir Singh, Daniel Monchuk, and Siobhan Murray for support with analysis and GIS, Gunther Fischer and Mahendra Shah for data, Jean-François Eudeline for building the synthetic indicator of tenure security, and Thierry Mayer and Jacques Ould Aoudia for their guidance and suggestions regarding the use of data on governance. The authors are also grateful to Derek Byerlee, Will Martin, and Jo Swinnen for insightful discussions and suggestions, the participants of the 2010 AAEA and NARSC conferences, and the Annual World Bank Conference on Land and Poverty 2012 for useful comments. Financial support from CEPREMAP, the TFESSD Trust Fund, PROFOR, the Bill and Melinda Gates Foundation and the Hewlett Foundation is acknowledged. The views expressed in this paper are those of the authors and do not necessarily reflect those of the International Monetary Fund or the World Bank, its Board of Directors, or the countries they represent. A supplemental appendix to this article is available at http://wber.oxfordjournals.org/.

THE WORLD BANK ECONOMIC REVIEW, VOL. 29, NO. 2, pp. 207–233 doi:10.1093/wber/lht034
Advance Access Publication October 21, 2013

sector, create employment, and provide access to financial services and technology. Others denounce this phenomenon as a "land grab" (Pearce 2012) and point to the irony of potentially large food exports from countries that may depend on food aid. A large body of case studies highlights that many projects seem speculative, lack a sound technical and economic basis, and fail to properly consult or compensate local people. Although the nature and desirability of the impacts are subject to debate, there is broad consensus that the wave of recent land acquisitions could have far-reaching implications for long-term food security, agricultural production patterns, and global stability. Thus, a better understanding and analysis of the factors underlying the wave of large-scale land deals is desirable.

Such an analysis is relevant for a number of development issues. One issue is the debate about the most appropriate structure of agricultural production. The exceptionally large poverty elasticity of growth in smallholder agriculture (Ligon and Sadoulet 2011, Loayza and Raddatz 2010), as demonstrated in recent rapid poverty reduction in Asian economies such as China, and the fact that the majority of the poor still live in rural areas have led many to highlight the importance of a farm structure based on smallholders for poverty reduction (Lipton 2009, World Bank 2007). However, disillusion with the limited success of smallholder-based efforts to improve productivity in Sub-Saharan Africa and the apparent export competitiveness of "mega-farms" in Latin America and Eastern Europe during the 2007–8 global food crisis have led many observers to suggest that despite a mixed record, the acquisition of land by large operators may provide a path out of poverty and to development (Collier and Venables 2011). However, high inequality associated with the concentration of land in large farms has negatively affected human and economic development because large farms have used their locally dominant position to monopolize markets (Binswanger et al. 1995), subvert the provision of public goods such as education (Nugent and Robinson 2010, Vollrath 2009), undermine financial sector development (Rajan and Ramcharan 2011), and restrict political participation (Baland and Robinson 2008).

Although case studies are gradually being complemented by efforts to systematically describe the scope of large land acquisitions (Anseeuw et al. 2012b), the reported data are often taken at face value and do not face proper scrutiny (Rulli et al. 2013).[1] Our paper contributes to this debate in two ways. First, we compare estimates of large transnational land-based investment from three sources. With some important caveats, the available data point toward a boom in the wake of the combination of the 2008 food price spike and financial crises, a focus of institutional investors on more mature segments of the market, and a dominant role of the state rather than private parties as the supplier of land in

1. Problems with the existing data are documented at http://ruralmodernity.wordpress.com/2012/04/27/the-land-matrix-much-ado-about-nothing/, http://oilforfood.info/?p=423, and http://www.chinaafricarealstory.com/2012/04/zombie-chinese-land-grabs-in-africa.html.

Africa. At the same time, we find that though they claim to focus on very different aspects of the phenomenon (expressions of demand at the height of the commodity boom and signed or verified deals), the quantities reported by these data sources are strikingly similar. The scope of existing databases to trace and differentiate distinct stages of the process of acquiring land and implementing investments seems very limited, and the ability to do so more clearly is likely to be a key criterion for reliable data sources.

A second issue relates to the determinants of transnational land demand. Noting that, lacking better data, such an analysis will have to be limited to demand rather than actual land transfers, we estimate both unilateral regressions for land demand (expressed by the number of projects) in a destination country and bilateral gravity models as a function of traditional demand shifters, newly developed data on potential land supply, and political and institutional variables. The results support the importance of supply (agro-ecological potential) and demand-side variables (population density and agricultural imports). Standard investment climate variables have less of a systematic effect than does land governance, which is consistently highly significant. However, counter-intuitively, we find that countries with weak tenure security and governance have been most attractive for investors, a result that is robust across a range of estimators and controls.

The paper is organized as follows. Section 2 contextualizes evidence on land demand and actual land transfers by drawing on the analysis of FDI in the macro-literature to suggest a methodological approach and to outline data needs. Section 3 presents cross-sectional data on land demand, discusses the econometric approach, and briefly presents relevant descriptive statistics. Key econometric results and robustness checks, as discussed in section 4, support the importance of food import demand as a motivation for countries to seek out land abroad ("push factors") and of supply in the form of agro-ecological suitability as key determinants for the choice of destination ("pull factors"). These results and checks also highlight the extent to which weak land governance seems to encourage rather than discourage transnational demand for land. Section 5 concludes by highlighting a number of implications for policy.

Conceptual Framework

Although the recent interest in large land deals implies that the agricultural economics literature analyzing this issue remains limited, methodological and substantive lessons can be drawn from studies on cross-country capital and investment flows. We briefly review conceptual considerations and econometric issues. This review is followed by a discussion of ways to measure the variables that may affect the country-level supply of and demand for land, institutional factors in terms of overall investor protection and the rule of law, and, specifically, the security of property rights to land.

Insights from the Literature on Foreign Investment Flows

A large body of empirical literature demonstrates that, with the exception of a limited number of plantation crops, the production of agricultural crops is characterized by constant or decreasing (once a certain minimum farm size that fully utilizes certain lumpy inputs, such as machinery or managerial capacity, has been reached) returns to scale. A key issue is that if effort cannot be observed, salaried workers, in contrast to family members who are residual claimants to profits, will exert optimum levels of effort only if they are subject to costly supervision. This phenomenon would reduce the competitiveness of large farms that rely on wage-labor compared to owner-operated farms. The former may have advantages in acquiring the capital needed to expand into frontier areas or overcoming market imperfections because of the absence of public goods. The history of large land deals (Byerlee and Deininger forthcoming) suggests that, traditionally, large operators' advantages remained limited and transitory unless these advantages were upheld by distortions (Binswanger et al. 1995, Deininger 2003). In the recent past, developments in crop breeding, tillage, and information technology may have facilitated the supervision of wage labor (Deininger and Byerlee 2012), possibly making large farms more competitive economically. In countries where financial systems do not work well, large farms' ability to reduce the cost of capital by accessing international equity markets can provide them with a distinct advantage (Deininger et al. 2013).

Although no cross-country studies empirically analyze large-scale foreign land acquisitions, the literature on foreign investment has explored methodologically similar issues. This literature suggests that the magnitude and distribution of capital flows to recipient countries are determined by pull and push factors (Calvo et al. 1996)[2] in addition to country-specific variables, such as cultural and geographical proximity or past bilateral ties (Benassy-Quere et al. 2007, Habib and Zurawicki 2002). Gravity models relating FDI between two countries to each partner's size, distance, and proxies for transaction cost are widely used in the literature to explain bilateral FDI (Wei 2000).[3] The results are largely consistent with the theoretical literature on trade and capital flows (Markusen and Venables 1998), suggesting that demand and supply factors complement the sector-specific drivers of FDI, such as a desire to be close to the market or to take advantage of lower production costs (Helpman 1984, Markusen and Venables 2000).

2. Push factors (e.g., the business cycle in industrialized countries) explain the magnitude of capital flows. Pull factors relate to the domestic country characteristics (e.g., economic performance) that help explain the distribution of capital flows across potential recipient countries.

3. The OECD defines FDI as "an activity in which an investor resident in one country obtains a lasting interest in, and a significant influence on the management of, an entity resident in another country. This may involve either creating an entirely new enterprise ("greenfield" investment) or, more typically, changing the ownership of existing enterprises via mergers and acquisitions". A takeover by a foreign firm is considered FDI if the foreign firm holds at least 10 percent of the voting rights on the board.

A key stylized fact with regard to overall investment flows, commonly referred to as the Lucas paradox (Lucas 1990), is that the volume of such flows remains well below the levels that neoclassical theory predicts would be needed to equalize returns to capital. This remained the case even after capital market liberalization vastly increased capital flows to developing countries (Prasad et al. 2007). Explanations focus on fundamental differences in economic structure, such as technology, missing production factors, policy, or the institutional environment, particularly sovereign risk asymmetric information, and the previous track record (Fan et al. 2009). Countries with a weak rule of law, high political or default risk, incipient financial markets, high transaction costs, or deficient governance may attract limited investment, even if they offer exceptionally high rates of return (Shleifer and Wolfenzon 2002). Cross-sectional analysis supports the key role of institutional factors to explain the magnitude and nature of capital flows toward developing and emerging economies (Alfaro et al. 2008). Panel techniques have been used to show not only that time invariant factors such as social norms, culture, geography, and trust affect foreign capital flows but also that foreign investors tend to reward policy reforms by increasing bank lending once institutional reforms have been implemented (Papaioannou 2009). These techniques also suggest that institutional variables, rather than human capital or income, are key factors underlying this relationship.

Investors have different vehicles at their disposal to realize any given level of investment. A key trade-off is between the length of commitment (and the ease of withdrawing funds) and the ability to exercise managerial control (Sawant 2010). The corporate finance literature suggests that a distinguishing feature of FDI vs. portfolio investment is the control investors enjoy over their assets. Asymmetric information, agency problems, and the use of proprietary technologies are likely to give rise to a preference for direct over portfolio investment (Albuquerque 2003). Greater control can alleviate the adverse consequences of the limited ability to enforce investors' rights (Schnitzer 2002), so direct investment may be preferred over other forms of investment. Thus, although weak governance may deter investments in absolute terms, the share of FDI in total capital flows is likely to be higher in countries with weak governance because investors will demand ways of investing that provide them with greater control (Hausmann et al. 2007).

Empirical Approach

Because we are interested in explaining the number of planned or actual investments in country j by investors from country i, we use a bilateral Poisson regression to model the occurrence and count of projects in an origin-destination pair. Indexing host countries by j, we let N_{ij} denote the number of investment projects received by host country j and originating in country i. Assuming that N_{ij} follows a Poisson distribution λ_{ij}, we can write

$$Prob(N_{ij}) = \frac{e^{-\lambda ij}\,\lambda_{ij}^{N_{ij}}}{N_{ij}!}.$$

Specifying λ_{ij} as a linear function of explanatory variables X_{ij} allows us to express the expectation of N_{ij} conditionally on a set of explanatory variables X_{ij}. Denoting the conditional expectation by L_{ij}, we obtain

$$L_{ij} = E\left[N_{ij}|X_{ij}\right] = e^{X_{ij}-B_{ij}}$$

where X_{ij} is a row vector of explanatory variables and B_{ji} is a column vector of corresponding coefficients. Taking logs then allows us to formulate a model that can be estimated as

$$l_{ij} = X_{ij}.B_{ij}$$

where l_{ij} is the logarithm of L_{ij} and parameter B_{ij} is estimated by maximum likelihood under the assumption that different realizations of the count variable L_{ij} (i.e., the number of investment projects) are independent from each other. As we estimate in the logarithms, the coefficients can be interpreted as elasticities or semi-elasticities (depending on the unit of the explanatory variable), and each element of the coefficient vector B_{ij} can then be interpreted as the change in the log of the conditional expectation of the planned or actual investments made in country j by investors from country i, resulting from a marginal increase in the value of the corresponding element of X_{ij}. In principle, X_{ij} can be partitioned into destination characteristics ($VarDest_j$), origin attributes ($VarOrig_i$), and bilateral variables ($VarBilat_{i,j}$) characterizing the specific origin-host pair. Formally, the bilateral count model (Poisson regression) is

$$l_{ij} = Var\,Orig_i.\alpha_i + Var\,Dest_j.\beta_j + Var\,Bilat_{ij}.\gamma_{ij}$$

where the variables are defined as above. In our empirical application, $VarOrig_i$ includes food dependence and the population of the country of origin, $VarDest_j$ includes a country's amount of "available" land or the maximum potential value of agricultural production on this land, the yield gap, institutional variables (see below), and the strength of investment protection, and $VarBilat_{i,j}$ includes the physical distance between the two countries and the existence of a historic colonizer/colonized relationship.

Large numbers of zeros and the heteroskedasticity of errors may imply that the OLS results will be biased and inconsistent. The Poisson pseudo-maximum-likelihood estimator is suggested to address this issue (Silva and Tenreyro 2006). We follow this suggestion and use tobit and zero-inflated Poisson models to check the robustness of our estimates.

Specific Determinants of Cross-Border Farmland Investment

Applying the above framework to explore the determinants of interest in cross-border farmland deals, although straightforward conceptually, requires information on key supply- and demand-side variables as well as institutional factors. On the supply side, we focus on the availability of high potential "uncultivated" land which is not forested, not protected, and not populated, and the "yield gap". On the demand side, we focus on population growth and food import dependence. Regarding the institutional environment, we consider variables for land governance, investor protection, and law and order.

The attractiveness of a country for farmland investment depends on the availability of land with high agro-ecological potential that is not yet used for intensive crop production. We rely on the bio-physical modeling of potential crop yields to obtain an estimate of the value of the potential output from any given piece of land, even if it is not currently cultivated.[4] To avoid problems (Young 2000), we use agro-ecological potential for rainfed cultivation, as defined by the global agro-ecological zoning project (Fischer et al. 2002). Because wheat, maize sorghum, soybean, sugarcane, oil palm, and cassava account for the majority of global agricultural output and span a wide range of agro-ecological conditions, we use them as indicator crops and simulate output for each of these crops using location-specific climatic conditions. The results of this approach, with output valued at 2005 prices (i.e., pre-crisis), are then compared for each five arc-minute grid-cell of the GAEZ v3.0 resource inventory to choose the crop with the highest output value, which then defines the output value for that grid-cell. Figure A.1 in the online appendix available at http://wber.orxfordjournals.org/ maps the resulting potential value of output per ha for all grid cells.

To make these data useful for our regressions, we overlay the map of potential output with information on actual land use and population density from a variety of databases.[5] This approach allows us to compute a measure of land supply as the potential output value from areas that are not forested, not protected, not already used for agricultural cultivation, and that have a population density below 25 inhabitants per km^2.[6] The rationale is that if potentially suitable land is forested or protected, it is likely to provide social or environmental benefits that

4. Note that our approach thus excludes the consideration of potential investment to establish irrigation, which would require more intensive modeling of hydrological flows and, furthermore, would encounter issues related to riparian rights and seasonal availability of water.

5. Our measure of agricultural land outside the forest and protected areas is constructed from various databases, including Global Land Cover 2000 (http://www-gem.jrc.it/glc2000), PAGE Global Agricultural Extent (http://www.ifpri.org/dataset/pilot-analysis-global-Ecosystems-page), Global Forest Resources Assessment 2000 (http://www.fao.org/forestry/32203/en), and the World Database on Protected Areas 2009 (http://www.wdpa.org/download.aspx). Population data are from LandScan 2003 Global Population (http://www.ornl.gov/Landscan/).

6. Based on this definition, the total land for potential expansion is 445 million ha, compared to approximately 1.5 billion ha already under cultivation. Most of this land (201, 123, and 52 million ha, respectively) is in Sub-Saharan Africa, Latin America, and Eastern Europe (Deininger et al. 2011a).

would make its use by investors very costly and risky, and that population density needs to be low for land to be considered potentially "available" for agricultural use. We also compute the notional value of potential output on all areas that are currently covered with forest. If our hypothesis is correct, we would expect the first variable, but not the second variable, to be a significant driver of land demand. Furthermore, we aggregate the value of potential output on currently cultivated areas at the country level and compare it with data on actual output to obtain a measure of the "yield gap", the difference between observed and potential yields under existing technology that can be exploited by working with existing producers without bringing new areas under cultivation. We note that, with all other things being equal, a higher yield gap should increase interest by foreign investors who are interested in quickly establishing production.

The literature suggests that much of the immediate demand for land in the wake of the 2008 crisis was driven by fears of political instability because of dependence on volatile food imports (Woertz 2013). To account for this demand, we complement standard bilateral information on physical, cultural, or geopolitical proximity (a previous colonial relationship) with information on origin countries' populations and past net food imports. We use three indicators to explore the links between foreign land acquisition and governance. First, data on regulatory quality, i.e., law and order, from the International Country Risk Guide (ICRG, 2009) serve as a proxy of general regulatory quality.[7] Second, a measure of investor protection from the "Doing Business" database provides information on the firm-specific regulatory environment.[8] Finally, because agricultural investment is more land-intensive than other FDI, land governance and land rights security are likely to be of great relevance.[9] We draw on a recent cross-country database on this issue (de Crombrugghe et al. 2009) to construct an indicator of tenure security for local users by using the first component from a principal component analysis on a set of key land governance variables.[10]

The effect of good land governance and strong protection of property rights on a country's attractiveness for land-intensive investment is an empirical issue.

7. The variable comprises a law sub-component assessing the strength and impartiality of the legal system and an order sub-component assessing popular observance of the law.

8. The index consists of a weighted average of indices measuring the transparency of transactions, the liability of company directors and shareholders, and the power of administrators to hold directors accountable for misconduct. Our variable is defined as the country's percentile in the ordered distribution of ranks regarding investor protection in the *Doing Business* database.

9. Key relevant aspects are the clarity of land rights and the way state land is managed, disposed of, and acquired because these elements have an important impact on land tenure security. For more details on land governance, see Deininger et al. (2011b).

10. The main contributing variables are (contributions in parentheses): "land tenure security" (16 percent), "public policies addressing land rights" (15 percent), "land ownership rights security" (14 percent), "diversity of tenure situations" (11 percent), "recognition by the State of the diversity of tenure situations" (10 percent), "scarcity of land-related conflicts" (10 percent), "traditional collective use and ownership" (9 percent), and "significance of land use policies" (6 percent). This first axis captures 40 percent of variance. Low values of the index imply low levels of tenure security.

On the one hand, the long-term horizon of some agricultural production cycles, particularly for perennials, is likely to make investors reluctant to tie up large resources in an environment where weak governance increases dangers of conflict with local users or of opportunistic government behavior and creeping expropriation (Schnitzer 1999). On the other hand, inexperienced investors may find it easier to establish property rights if (land) governance is weak, especially if they believe that it is easier and more "secure" to acquire land directly from governments rather than to engage in dialogue with local populations.[11]

Data on Cross-Border, Large-Scale Land Acquisition

We document problems with the data and how these problems constrain the ability to analyze the "land rush". Because the databases include few very large deals that did not materialize, the analysis is limited to proposed projects at the country level, and any further analysis is likely to require primary data from government registries. With this caveat, we note that interest in large-scale agricultural investment of the type considered here hardly existed before a very rapid peak in 2008–9. The focus was on Africa, where most proposed deals involve firms interested in acquiring land from the government rather than private parties, in marked contrast to the predominant role of funds and the prevalence of market-based land transfers in more mature environments.

Global Evidence

In principle, information on cross-border, large-scale land acquisitions should be from national registries that are supported by periodically updated record tracking, economic performance, and investors' compliance with contractual obligations.[12] In practice, destination countries' limited institutional capacities and weak regulatory framework often mean that such information is not systematically gathered or analyzed (Deininger et al. 2011b).[13] Consequently, much of the data underpinning the conclusions in the literature on large-scale land acquisitions originate from secondary sources, such as press reports. To explore the data quality and conduct a descriptive analysis, we draw on three distinct data sets that purport to refer to interest in land acquisition, signed deals, and transfers verified on the ground.

11. Weak protection of property rights by the state implies a greater need for private enforcement, an issue that has often proven problematic in the past. For an interesting perspective, see the story of Jarch capital in Southern Sudan (Funk 2010).

12. Although inventory data suggest that a large share of large land acquisitions may be by domestic rather than foreign buyers, the existing databases fail to provide information on this. The implicit assumption seems to be that even a minority stake by a foreigner qualifies a deal as cross-border.

13. Reasons include the nature of a country's land administration system (e.g., the role of chiefs in the case of Ghana), the balance between market and non-market transfers, gaps in capacity and resources with agencies often overwhelmed by unanticipated demand, and overlaps in responsibility whereby "approvals" are often given at different levels in the hierarchy or by institutions not authorized to do so.

Our first dataset is based on media reports published at the height of the commodity price boom, between October 2008 and August 2009 by the NGO GRAIN.[14] In light of the limited time period covered by these data, the widely reported fact that only a small fraction of intended land acquisitions led to actual transfers, and the possibility that, without geo-referencing intended locations, the efforts to eliminate double counting by eliminating reports that refer to the same piece of physical land may not always have been fully successful, the use of this dataset is likely to provide an upper-bound estimate of the immediate response triggered by the 2007–8 boom. The second dataset, referred to below as A&C, is based on an algorithm of systematic automated web searches that has been used successfully as the basis for a commercial subscription service (initially, to document closures of industrial plants in France and now applied to large-scale land investments).[15] These data are limited to "signed deals" prior to 2012 (Alomar and Cousquer 2012). Both datasets may be biased if systematic cross-country differences in press freedom or internet access affect the reporting of deals. Our third source of data, the "land Matrix", reports deals that have undergone ground verification by NGOs affiliated with the International Land Coalition (Anseeuw et al. 2012a) and are thus not affected by such concerns.

Differences in the variables covered across databases, together with data gaps and missing values for many of the variables, create challenges to efforts to distil simple stylized facts about the "land rush" (see table A.1 in the online appendix). For example, the size of the (proposed) land transfer is missing in approximately 57 percent of observations in the 2008–9 demand assessment. Additionally, in the land Matrix data, close to 80 percent of transfers lack information on transaction dates, making it impossible to assess whether such transfers accelerated recently. Information on the type of seller/investor and the projected amounts of investment or jobs to be created is absent virtually everywhere. More consistent data gathering with proper quality control procedures could have substantial benefits for analysts and policy makers who are currently unable to compare their country to others in terms of the "quality" and expected local benefits from such investments.

Although our three sources refer to very different concepts, they provide very similar estimates of the phenomenon (table 1). With some 56 million ha in 390 projects and 54 million ha in 848 projects, respectively, A&C and the land Matrix arrive at higher estimates for the amount of land involved in signed or verified deals than the 45 million ha in 453 projects for which interest had been expressed, based on Grain data, at the height of the boom. This finding is unexpected because many intended deals are known to have never materialized or to have been implemented at a much smaller scale than originally envisaged (Schoneveld 2011).

We also note that in all datasets, a few "mega"-projects above 1 million ha (nine with a total size of 23 million ha in Grain and seven with 24 and 12 million

14. All media reports can be accessed at www.farmlandgrab.org.

15. The ultimate goal is to continue collecting these data and to make them available to subscribers. We thank R. Alomar and D. Cousquer for kindly making historical data available to us for analysis.

TABLE 1. Comparing the Total and Regional Extent of Land Projects in Three Key Databases

	All	AFR	EAP	ECA	LAC	MNA	UEA
1. DEMAND IN 2008–9 (Grain)							
Total area (mn ha)	45.179	27.232	8.562	4.556	3.181	1.420	0.228
Projects (#)	453	216	95	47	47	25	23
Countries affected (#)	82	35	7	12	11	6	11
Projects > 1 mn ha (#)	9	4	2	1	1	1	0
Projects > 250k ha (#)	30	15	8	6	1	0	0
Area < 1 mn ha	22.109	11.132	5.322	3.326	1.981	0.120	0.228
Area < 250k ha	7.134	3.548	1.270	0.886	1.081	0.120	0.228
2. SIGNED AFTER 2008 (A&C)							
Total area (mn ha)	56.223	34.202	2.528	6.482	4.121	1.527	7.363
Projects (#)	390	192	36	56	57	8	41
Countries affected (#)	67	28	5	9	11	5	9
Projects > 1 mn ha (#)	7	5	0	1	0	0	1
Projects > 250k ha (#)	34	19	2	4	4	2	3
Area < 1 mn ha	32.303	17.102	2.528	5.262	4.121	1.527	1.763
Area < 250k ha	17.344	8.393	1.704	3.390	2.818	0.327	0.711
3. GROUND VERIFIED (land Matrix)							
Total area (mn ha)	54.054	23.334	23.372	1.776	5.166	0.005	0.401
Projects (#)	848	439	270	18	117	1	3
Countries affected (#)	55	27	4	9	4	0	11
Projects > 1 mn ha (#)	7	2	5	0	0	0	0
Projects > 250k ha (#)	37	14	15	1	6	0	1
Area < 1 mn ha	42.715	20.354	15.013	1.776	5.166	0.005	0.401
Area < 250k ha	25.059	13.906	7.024	1.453	2.659	0.005	0.012

Note: AFR = Sub-Saharan Africa, EAP = East Asia and Pacific, ECA = Eastern and Central Europe, LAC = Latin America and Caribbean, MNA = Middle East and North Africa, UEA = United States, Europe, and Australia.

Source: Authors' computation from the relevant databases, as explained in the text.

ha, respectively, in A&C and the land matrix) affect estimates of total area. Eliminating these reduces the estimated size of land deals, consistent with the notion that large parts of early demand may have been speculative and dominated by a few very ambitious projects. Surprisingly, however, if transactions greater than 1 million ha are eliminated, the size of "ground-verified" deals, as reported by the land Matrix (42 million ha in total), amounts to almost double the demand articulated in 2008–9 (22 million ha) and significantly exceeds even the amount of supposedly signed deals during the 2008–12 period based on A&C (32 million ha). This finding suggests weaknesses in the field verification procedures applied by the land Matrix, although the paucity of variables reported makes it impossible to verify these systematically.[16] The number of target countries also varies across data sources, with 82 in the Grain data, followed by 67 in

16. Together with weak documentation and the fact that the database made available publicly is updated on a continuing basis without keeping track of previous versions, this reinforces the notion that the land Matrix seems be more of an advocacy tool than a rigorous scientific effort. Because the land Matrix does not include information on the timing of transactions, cross-checking is virtually impossible.

A&C and 55 in the land Matrix. All data sources coincide in suggesting that there has been a disproportionate focus on Africa, which consistently accounts for some 50 percent of the area involved.[17]

Subject to caveats regarding the consistency of reporting and data quality, a comparison of A&C and Grain allows us to identify a few regularities in land investment (table 2). Direct involvement by governments or SWFs appears to have been limited. In line with the literature on corporate finance, direct rather than portfolio investment predominates in Africa (where it makes up 75 percent of projects), whereas funds focus on more "mature" market segments, including North America, Europe, and Australia. Although joint ventures had limited relevance according to the data, the share of purchases in total acquisitions seems proportional to the level of institutional development; almost 90 percent of the reported transactions were purchases in the US, Europe, and Australia, compared to only about one third of the transactions in Africa. Africa also stands out in that, for almost 90 percent of the known cases, the "seller" is the government rather than a private party or user group, in line with the notion that in Africa, state usurpation of communal land rights is a key risk (Alden-Wily 2010).

Although only one of our databases has information on the time of acquisition, it provides interesting insights (table 3). First, although there was little activity before 2008 (total transfers of only 2 million ha), the volume of reported signed deals increased to 6 million ha in 2008 and 30 million in 2009, followed by a drop to 9 and 10 million thereafter. This boom-bust cycle is more pronounced for biofuels (which account for 11 percent, 37 percent, and approximately 10 percent-15 percent of acquisitions before, during, and after 2008, respectively) and in Africa (53 percent in 2008, reduced to less than 20 percent in 2009 and less than 10 percent in 2011). Possibly as a result of limited alternative investment opportunities, the involvement of funds also peaked in 2008. Governments had not acted as buyers at all in the period before 2008, and although they were most active in 2008, their presence continued.

Disaggregating country-level data for Africa indicates differences across the databases (table 4). The top destinations in terms of the number of investments are Ethiopia, Sudan, Mozambique, and Tanzania (22 percent, 15 percent, 13 percent, and 12 percent, respectively) for A&C; Mozambique, Ethiopia, Tanzania, and Madagascar (25 percent, 20 percent, 15 percent, and 11 percent) for the land Matrix; and Sudan, Ethiopia, Nigeria, and Ghana (19 percent, 15 percent, 11 percent, and 11 percent) for Grain. Regarding the investors' regions of origin, all databases attribute a significant role to investors from Western Europe, who account for between 40 percent and 43 percent of total investment. The databases diverge on the rest of the investors, however, indicating that the second most important origin region is the Middle East, according to Grain (29 percent); Africa

17. Beyond the focus on Africa, databases differ regarding the relative importance of other regions; whereas Grain and the Matrix coincide in pointing toward EAP, A&C has EAP as a distant fifth after UEA, ECA, and LAC, partly because of a stronger focus on "market" transactions.

TABLE 2. Key Characteristics of Land Projects according to the Three Databases, All Countries and by Region

	All	AFR	EAP	ECA	LAC	MNA	UEA
1. DEMAND IN 2008–9 (Grain)							
Acquisition type (percents)							
Lease	44.6	59.1	55.4	43.3	15.6	33.3	11.1
Purchase	46.8	32.6	23.4	56.7	81.3	66.7	83.4
Concession	8.6	8.3	21.2	0.0	3.1	0.0	5.5
Intended use (percents)							
Biofuels	20.8	28.0	15.9	6.7	26.2	0.0	15.8
Food	37.8	34.4	52.3	48.9	11.9	70.0	0.0
Industrial/Plantation	22.0	21.7	20.4	20.0	35.7	15.0	15.8
Livestock	19.3	15.9	11.4	24.5	26.2	15.0	68.5
Type of buyer (percents)							
Public agency	25.8	25.7	33.3	27.8	26.3	21.1	0.0
Private firm	36.1	44.2	30.4	24.9	28.9	26.3	31.6
Private fund	38.1	30.1	36.2	47.3	44.7	52.6	68.4
2. SIGNED AFTER 2008 (A&C)							
Acquisition type (percents)							
Purchase	51.8	28.4	29.0	78.6	75.0	50.0	87.8
Lease	43.1	66.1	54.8	19.6	21.2	50.0	9.8
Joint venture	5.1	5.4	16.1	1.8	3.8	0.0	2.4
Type of seller (percents)							
Seller gov't	54.8	88.1	70.9	11.9	18.0	57.1	2.8
Seller private	45.2	11.9	29.1	88.1	82.0	42.9	97.2
Type of buyer (percents)							
Buyer private firm	67.3	75.3	82.8	49.1	68.4	50.0	42.5
Private fund	25.4	15.3	5.8	45.4	31.6	37.5	52.5
Gov't/SWF	7.3	9.5	11.4	5.5	0.0	12.5	5.0
Intended use (percents)							
Crop biofuel	22.8	39.1	16.7	0.0	12.3	12.5	0.0
Food	58.7	48.4	63.9	94.6	66.7	75.0	39.0
Other	18.5	12.5	19.4	5.4	21.1	12.5	61.0
Investment amount							
Info non-missing (percent)	23.3	14.6	25.0	14.3	29.8	25.0	65.9
Investment/ha (US$)	9,071	13,910	5,699	1,602	3,283	2,069	11,000
3. GROUND VERIFIED (land Matrix)							
Intended use (percents)							
Biofuels	20.0	26.9	17.4	0.0	5.6		0.0
Food	18.5	21.1	12.6	66.7	15.7		0.0
Industry/plantation	38.0	32.0	44.9	5.6	47.2		100.0
Other	23.5	20.0	25.1	27.8	31.5		0.0

Note: AFR = Sub-Saharan Africa, EAP = East Asia and Pacific, ECA = Eastern and Central Europe, LAC = Latin America and Caribbean, MNA = Middle East and North Africa, UEA = United States, Europe, and Australia.

Source: Authors' computation from relevant databases, as explained in the text. Only cases with information reported are considered, i.e., "not known" is coded as missing throughout.

TABLE 3. Time Variation in the Nature of Signed Land Deals (A&C database)

Year	Type	Total	AFR	UEA	EAP	ECA	MNA	LAC
Total	Area total (mn ha)	56.990	34.404	7.518	2.914	6.790	1.623	3.741
	Biofuel (percent)	16.9	23.1	0.0	23.9	0.0	30.8	12.7
	Buyer fund (percent)	24.2	4.4	82.7	11.2	45.2	49.7	49.6
	Buyer gov't (percent)	7.8	9.5	4.0	15.5	6.0	1.2	0.0
	Seller gov't (percent)	52.5	75.0	3.8	54.9	6.3	57.5	22.3
Before	Area total (mn ha)	2.047	0.859	0.154	0.386	0.308	0.096	0.243
2007	Biofuel (percent)	11.3	23.2	0.0	8.5	0.0	0.0	0.0
	Buyer fund (percent)	11.4	2.3	0.0	0.0	12.0	100.0	33.0
	Buyer Gov't (percent)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Seller gov't (percent)	45.6	39.5	96.7	86.3	0.0	100.0	6.6
2008	Area total (mn ha)	5.932	3.806	0.202	0.593	0.844	0.002	0.485
	Biofuel (percent)	36.7	53.0	0.0	16.9	0.0	0.0	12.4
	Buyer fund (percent)	15.6	1.8	14.0	55.0	12.4	100.0	81.7
	Buyer gov't (percent)	11.9	18.6	0.0	0.0	0.0	0.0	0.0
	Seller gov't (percent)	39.6	54.6	69.4	20.2	0.0	100.0	1.7
2009	Area total (mn ha)	30.408	20.261	5.608	0.844	2.399	0.772	0.524
	Biofuel (percent)	15.4	19.2	0.0	62.2	0.0	0.0	50.9
	Buyer fund (percent)	31.5	4.3	99.9	0.0	87.3	92.0	57.6
	Buyer gov't (percent)	8.1	10.5	0.0	24.4	4.2	2.6	0.0
	Seller gov't (percent)	59.9	81.4	0.0	100.0	4.2	96.1	4.8
2010	Area total (mn ha)	8.514	3.251	0.201	0.790	2.141	0.754	1.378
	Biofuel (percent)	22.6	39.6	0.0	3.5	0.0	66.4	7.6
	Buyer fund (percent)	22.8	4.8	45.9	0.0	37.4	0.0	64.8
	Buyer gov't (percent)	1.5	3.9	1.8	0.0	0.0	0.0	0.0
	Seller gov't (percent)	32.4	70.3	0.0	4.3	4.2	12.5	18.3
2011	Area total (mn ha)	10.090	6.226	1.353	0.302	1.099	0.000	1.111
	Biofuel (percent)	6.0	8.9	0.0	3.6	0.0	0.0	3.9
	Buyer fund (percent)	11.0	6.4	37.0	0.0	2.9	0.0	16.6
	Buyer gov't (percent)	11.3	4.6	22.2	81.2	28.2	0.0	0.0
	Seller gov't (percent)	56.6	74.9	0.0	89.6	21.8	0.0	48.0

Note: AFR = Sub-Saharan Africa, EAP = East Asia and Pacific, ECA = Eastern and Central Europe, LAC = Latin America and Caribbean, MNA = Middle East and North Africa, UEA = United States, Europe, and Australia.

Source: Authors' computation based on all signed transfers from A&C database (see description in text). Percentages are weighted by area.

(27 percent), according to the land Matrix; and East Asia or North America (17 percent each), according to A&C.

Descriptive Statistics for Key Dependent Variables

The means of the dependent variables for "origin" or "destination" countries based on the three databases, distinguishing between whether a project is reported as having started in the Grain or A&C databases, are displayed in table 5. Between 0.9 percent (in A&C) and 5.7 percent (based on the land Matrix) of the country pairs share a colonial heritage, with a mean distance of 5,500 to 7,500 km between them. The size of the cultivated area is approximately double

TABLE 4. Distribution of Projects among Main Targeted African Countries according to the Three Different Databases

	Area (mn ha)	Projects		Origin of investor				
		No	percent among main targeted countries	Africa	East Asia	M. East	N. America	W. Europe
1. DEMAND IN 2008–9 (Grain)								
Total Africa	27.23	216		14.9	13.9	28.7	3.1	39.5
Ethiopia	0.81	21	15.0	27.8	5.6	44.5	0.0	22.2
Ghana	0.53	15	10.7	14.2	7.2	7.2	0.0	71.4
Madagascar	1.94	14	10.0	9.0	18.2	18.2	0.0	54.6
Mali	0.60	9	6.4	11.1	0.0	33.3	11.1	44.4
Mozambique	0.18	14	10.0	33.4	8.3	8.3	8.3	41.7
Nigeria	0.03	16	11.4	43.8	12.5	18.8	0.0	25.0
Sudan	3.88	26	18.6	7.7	15.4	69.3	3.8	3.8
Sierra Leone	0.00	3	2.1	0.0	33.3	0.0	0.0	66.7
Tanzania	1.78	12	8.6	0.0	9.1	27.3	0.0	63.6
DRC	12.87	4	2.9	25.0	25.0	0.0	25.0	25.0
Zambia	2.00	6	4.3	0.0	50.0	33.3	0.0	16.7
Other	2.64	76		9.2	15.4	23.0	3.0	49.2
2. SIGNED AFTER 2008 (A&C)								
Total Africa	34.20	192		10.5	17.2	15.9	16.6	39.9
Ethiopia	2.19	32	22.2	17.7	5.8	29.4	17.7	29.4
Ghana	0.68	10	6.9	0.0	10.0	20.0	20.0	50.0
Madagascar	0.74	3	2.1	0.0	33.3	0.0	0.0	66.7
Mali	0.37	11	7.6	11.1	11.1	11.1	44.4	22.2
Mozambique	1.85	18	12.5	6.3	0.0	0.0	18.8	74.9
Nigeria	0.53	5	3.5	0.0	0.0	25.0	25.0	50.0
Sudan	6.12	22	15.3	15.0	15.0	50.1	20.0	0.0
Sierra Leone	0.49	11	7.6	0.0	30.0	10.0	0.0	60.0
Tanzania	1.32	17	11.8	0.0	25.0	6.3	18.7	50.1
DRC	15.04	10	6.9	30.0	30.0	0.0	20.0	20.0
Zambia	0.09	5	3.5	20.0	0.0	20.0	0.0	60.0
Other	4.78	48		11.6	25.6	9.3	11.6	41.9
3. GROUND VERIFIED (land Matrix)								
Total Africa	23.33	439		26.9	7.2	11.5	11.5	42.9
Ethiopia	4.77	71	20.1	22.5	4.1	24.5	18.4	30.6
Ghana	0.67	9	2.5	11.1	0.0	11.1	11.1	66.7
Madagascar	3.78	38	10.8	22.5	9.7	6.5	9.7	51.6
Mali	0.58	27	7.6	42.9	9.5	19.0	14.3	14.3
Mozambique	1.97	89	25.2	22.0	0.0	3.1	3.1	71.9
Nigeria	0.36	20	5.7	40.0	0.0	0.0	0.0	60.0
Sudan	3.92	18	5.1	5.9	0.0	52.9	23.5	17.7
Sierra Leone	0.72	13	3.7	14.3	0.0	0.0	28.6	57.1
Tanzania	1.38	54	15.3	24.2	9.2	0.0	12.1	54.5
DRC	0.24	6	1.7	0.0	0.0	0.0	0.0	0.0
Zambia	0.27	8	2.3	33.3	0.0	16.7	0.0	50.0
Other	4.66	86		37.7	14.5	2.9	7.2	37.7

Source: Authors' computation from the relevant databases (see description in the text).

in origin countries compared to destination countries throughout. The non-forested area that, according to our criteria, could be available for expansion is between two and three times larger in destination countries compared to origin countries, although the potential output per ha is slightly lower in destination countries. With between 65 percent and 72 percent in destination countries vs. 30 percent to 36 percent in target countries, the yield gap is approximately double in the former vs. the latter.

On the demand side, origin countries are net importers of food and are significantly more populous than destinations, which are less populous and are characterized by small net exports. The values of our governance indices consistently point toward lower protection of investors' interests, less robust law and order, and weaker land governance in destination countries compared to origin countries.[18] This finding suggests that the pull of supply-side factors (i.e., ample land availability) may outweigh concerns about limited institutional capacity.

The bottom panel of table 5 also highlights the share of countries targeted in each of the regions together with the average number of projects per country in each of them, indicating that, according to the Grain data, 37 percent of the countries with an average of 2.11 investments per country (or 5.7 for each country with non-zero investment) were targeted and that 31 percent (with 1.4 projects) had some activity overall. The share was almost 70 percent among African countries (with an average of 4.4 projects per country) but only 8 percent (with 0.64 projects per country) in East Asia and the Pacific. These shares are slightly lower for the A&C and land Matrix data.

Econometric Results

Although our analysis is limited to demand rather than actual investment, in a scenario of high commodity prices, such demand may well be realized. Unilateral and bilateral models suggest that (i) the availability of suitable but uncultivated land for expansion is a key driver of land demand; (ii) the difference between potential and actual yield on land already cultivated (the "yield gap"), a key predictor of the ability to quickly increase production, has no consistent impact; and (iii) the quality of land governance and, in some cases, law and order is highly significant throughout, suggesting that land demand has been higher where protection for such rights and the security of property remain weak.[19]

Results of Unilateral Regressions

The results of a Poisson regression with the count of large-scale land acquisition projects in the country of destination as the dependent variable are reported in

18. Institutional variables are correlated with correlation coefficients of −0.44 and 0.63 between land governance and investor protection and law and order, respectively.

19. The main results using Law and Order from ICRG (2009) are robust to using Rule of Law from Kauffman *et al.* (2009).

TABLE 5. Descriptive Statistics for Origin and Destination in the Three Different Databases

	Grain				A&C				Land Matrix	
	All		Started		All		Started		All	
	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest
Descriptive statistics										
Distance (km)	5979.87		6024.46		7403.6		6828.7		5642.09	
Former colonial relation (percent of all pairs)	0.023		0.017		0.009		0.014		0.057	
Supply factors										
Cult. area (mn ha)	40.13	21.9	43.22	25.86	46.67	17.08	43.32	24.74	34.6	15.51
Non-forest land suit. (mn ha)	3.95	13.45	5.03	14.65	4.45	16	5.58	16.65	5.42	14
Max. poss. output non -forest ($US mn)	21,474	38,009	24,866	39,894	26,401	38,911	28,691	44,434	25,300	25,312
Forest land suit. (mn ha)	10.52	18.34	12.74	21.55	14.62	17.97	17.72	25.26	14.73	12.54
Max. poss. output forest ($US mn)	43,889	78,084	51,144	84,053	58,497	76,449	67,297	95,009	12,099	12,108
Yield gap (percent)	0.35	0.68	0.32	0.65	0.3	0.68	0.3	0.67	0.36	0.72
Demand factors										
Total population (mn)	26300	9500	28900	10600	29600	6660	20100	7430	15900	7120
Net food exports ($US bn)	−3.23	1.33	−3.51	1.73	−1.61	1.33	−0.60	2.52	0.11	1.11
Food exports ($US bn)	12.36	4.40	14.93	5.50	15.08	3.82	18.40	6.21	15.74	3.17
Institutional environment										
Land governance	1.02	−1.22	1.10	−1.15	0.97	−1.18	1.81	−0.90	1.02	−1.42
Weak Investor protection	58.07	88.73	59.72	86.79	59.55	81.56	45.98	86.6	54	94.78
Law and order	4.55	3.24	4.6	3.36	4.53	3.17	4.71	3.35	4.56	3.1
Share of countries targeted (percent)										
Total		37.4		31.1		30.6		18.9		24.3
Africa		69.1		58.2		58.2		36.4		47.3
America		26.0		24.0		22.0		14.0		22.0
Asia		46.9		34.7		24.5		18.4		24.5
Europe		16.3		14.0		23.3		7.0		4.7
Pacific		8.0		8.0		12.0		12.0		12.0

(Continued)

TABLE 5. Continued

	Grain				A&C				Land Matrix	
	All		Started		All		Started		All	
	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest
	Average number of projects per country									
Total		2.11		1.35		1.99		0.63		2.68
Africa		4.36		2.69		3.98		1.38		5.53
America		1.08		0.82		1.40		0.36		1.78
Asia		2.84		1.84		1.53		0.71		3.84
Europe		0.47		0.28		0.88		0.09		0.19
Pacific		0.64		0.36		1.56		0.28		0.20

Notes: The table shows unweighted averages of country characteristics based on a total of 215 countries. The yield gap is the difference between the performance that is technically achievable and the effective yield observed (Source: FAO and IIASA). For the land governance indicator (see our footnote in the text regarding its construction from IPD 2009), low values imply low levels of tenure security. For weak investor protection (constructed from Doing Business), a high value corresponds to a situation in which investors' rights are weakly protected. For rule of law (constructed from the Worldwide Governance Indicators database), a low value characterizes a country in which governance is poor.

Source: Authors' computation from the relevant databases (see description in the text).

TABLE 6. Results from Unilateral Regressions of the Number of Projects in the Three Databases

	Grain		A&C		Land Matrix
	Total	Started	Total	Started	
Max potential outp. non-forest	1.1538***	1.1255***	1.7200***	0.8008***	0.4742***
	[0.186]	[0.150]	[0.302]	[0.144]	[0.123]
Max potential outp. forest	−0.6333***	−0.6404***	−1.0907***	−0.0797	0.1301
	[0.173]	[0.139]	[0.277]	[0.133]	[0.114]
Landlocked	−0.5110***	−0.4004***	−0.9878***	−0.1257	−0.0769
	[0.188]	[0.146]	[0.320]	[0.142]	[0.122]
Yield gap	−0.1367	0.1328	0.4108	1.0241***	0.1505
	[0.445]	[0.361]	[0.669]	[0.365]	[0.334]
Land governance (norm.)	−0.4042***	−0.3947***	−0.3972***	−0.2081***	−0.6566***
	[0.094]	[0.075]	[0.137]	[0.076]	[0.069]
Law and order (norm.)	−0.0117	−0.0099	−0.0360	0.2959***	0.1382**
	[0.083]	[0.067]	[0.122]	[0.065]	[0.058]
Weak investor protection (norm.)	−0.0465	−0.1099*	−0.2145*	0.0508	−0.0673
	[0.075]	[0.060]	[0.110]	[0.066]	[0.058]
Observations	97	97	97	97	97
Pseudo R-squared	0.336	0.361	0.334	0.447	0.385
With region dummies					
Land governance	−0.2592**	−0.2378***	−0.1598	−0.3437***	−0.2928***
	[0.111]	[0.088]	[0.162]	[0.094]	[0.079]

Notes: The dependent variable is the number of projects reported in a country. A constant is included throughout but not reported.

Source: Authors' analysis based on data as explained in the text.

table 6 for information on all projects and for projects with some activity from Grain (columns 1 and 2) and A&C (columns 3 and 4) as well as total projects from the land Matrix (column 5). The point estimate of potential output on the non-forested area is positive and significant throughout, whereas the point estimate for potential on forested area is negative in all but two regressions (where it lacks significance). In terms of magnitude, the coefficients for potential output on non-forest and forested area suggest that, other things equal, a 10 percent increase in potential output value on non-forest or forest land would increase the number of projects by 5–19 percent or reduce it by up to 10 percent, respectively. Surprisingly, the "yield gap" is not significant throughout for the total number of projects, which is consistent with the notion that a desire to better utilize potential on land that is already cultivated was not a main driver of the "land rush".

To facilitate comparison, we normalize the land governance variables to have zero mean and unit variance. The coefficient on land governance is negative and significant throughout, whereas the coefficients on other governance variables

are rarely significant. This finding supports the notion that, instead of land acquisition being contingent on the strong protection of rights, weak tenure security for existing occupants at the country level has been associated with higher investor interest in land-related investment. *Prima facie*, this would imply that civil society concerns about extractive or speculative motives with little concern about benefits to local populations may not be entirely misplaced. The association with land governance is large enough to be economically meaningful; a reduction in the land governance index by one standard deviation, equivalent to the difference between Brazil and Angola, is predicted to be associated with a total number of projects that is lower by between 36 percent (land Matrix) and 18 percent (A&C) and a number of started projects that is lower by 7 percent to 16 percent.

Results of Bilateral Regressions

Bilateral models provide a richer way of exploring determinants of the "land rush". Poisson regressions of the number of projects for any bilateral investor/host pair are thus estimated (see table 7, where the coefficient of the land governance indicator from an equivalent regression including regional dummies is reported at the bottom). We note that distance (negative effect) and a former colonial relationship (positive effect) are strong predictors of an investment relationship consistently across databases. In terms of supply-side characteristics, the regressions suggest that, as in the unilateral case, higher potential output from non-forested land is associated with the higher attractiveness of a country to investors. According to these results, a 10 percent increase of potentially cultivable land would be associated with an increase in the number of projects in a host country of between 6 percent and 9 percent. The value of the potential output from forest land is significant in some cases. The coefficient on the yield gap, though positive, is insignificant or of marginal significance in all regressions for the total number of projects, except those for the land Matrix and started projects in A&C, where it has a positive coefficient. Low yields and the associated opportunity to catch up or even leapfrog to the technology frontier seem to have been less important in terms of increasing a country's attractiveness as a target for land acquisition than the availability of high-potential land that is not yet under cultivation.

In terms of demand factors, higher population levels and per capita food imports in origin countries are strongly positively associated with higher demand for land investment.[20] This finding may indicate that a desire to acquire land may increasingly complement traditional means of dealing with imbalances in food

20. Note that we do not include a measure of overall income in our regressions. One reason is that we want to focus on the effect of some specific characteristics of the agricultural sector rather than on the effect of overall economic performance on attracting investment. Another reason is that income *per capita* is often seen as an outcome of institutions and governance structure (Acemoglu et al. 2001), which are already included in our regressions. As indicated in table 3 in the online appendix, the main results presented in this paper are robust to the inclusion of both income indicators and regional dummies.

TABLE 7. Results from Bilateral Regressions of the Number of Projects according to Three Different Databases

	Grain		A&C		Land Matrix
	Total	Started	Total	Started	
Bilateral variables					
Distance (log)	−0.6758***	−0.5954***	−0.2025*	−0.4108***	−0.9163***
	[0.057]	[0.050]	[0.122]	[0.056]	[0.032]
Former colonial relation	0.5746*	0.9642***	1.2569***	1.4614***	1.5348***
	[0.312]	[0.214]	[0.356]	[0.188]	[0.170]
Origin country variables					
Value net food imports	2.8002***	3.3382***	3.0151***	1.1044***	0.3883
	[0.239]	[0.186]	[0.381]	[0.259]	[0.256]
Population (log)	0.7041***	0.7669***	0.8364***	0.6875***	0.6863***
	[0.038]	[0.031]	[0.056]	[0.029]	[0.027]
Destination country variables					
Landlocked	−0.4007**	−0.3887**	−1.0754***	0.0281	0.2128*
	[0.195]	[0.156]	[0.329]	[0.146]	[0.127]
Max potential outp. non-forest	0.6740***	0.6588***	0.8970***	0.6355***	0.5723***
	[0.081]	[0.066]	[0.128]	[0.069]	[0.064]
Net food import value	0.1761***	0.1035***	0.0012	0.1224***	0.2084***
	[0.048]	[0.037]	[0.063]	[0.037]	[0.034]
Max potential outp. forest	−0.1644***	−0.1534***	−0.2684***	0.0589	0.0598
	[0.055]	[0.044]	[0.084]	[0.046]	[0.042]
Yield gap	0.7860	0.7568*	0.5882	1.6923***	1.1934***
	[0.531]	[0.432]	[0.796]	[0.440]	[0.420]
Land governance (normalized)	−0.5066***	−0.4574***	−0.4258***	−0.3200***	−0.7597***
	[0.096]	[0.079]	[0.144]	[0.078]	[0.069]
Law and order (normalized)	−0.1089	−0.0812	−0.0306	0.2209***	0.0039
	[0.085]	[0.070]	[0.122]	[0.065]	[0.060]
Weak investor protection (normalized)	−0.0537	−0.1140*	−0.2455**	0.0487	−0.0802
	[0.077]	[0.063]	[0.113]	[0.068]	[0.060]

(Continued)

TABLE 7. Continued

	Grain		A&C		Land Matrix
	Total	Started	Total	Started	
	18,333	18,333	18,333	18,333	18,333
Pseudo R-squared	0.243	0.276	0.275	0.276	0.350
With region dummies					
Land governance	−0.2308*	−0.2152**	−0.1052	−0.3498***	0.0018
	[0.118]	[0.096]	[0.172]	[0.099]	[0.088]

Notes: The dependent variable is the number of projects in a country pair. A constant is included throughout but not reported.
Source: Authors' analysis based on data, as explained in the text.

supply through markets and storage. With the exception of land governance, coefficients on institutional variables are weakly significant at most, suggesting that even when other factors are accounted for, high levels of institutional maturity are not a precondition for large amounts of land-related investment. On the contrary, the coefficient on host countries' quality of land governance, which accounts for the extent to which local rights are recognized, is highly significant and negative. Thus, consistent with the bilateral results, weak land governance seems associated with higher attractiveness to investors at the country level. From a substantive point of view, this finding resonates with evidence that, unless well-governed institutions exist to manage these resources, resource booms may fuel rent-seeking and corruption (Bhattacharyya and Hodler 2010) instead of development (Oechslin 2010). In the context of land-related investment, transparency and disclosure, a proper regulatory framework, and the lack of market mechanisms to liquidate non-performing ventures have been of particular concern.

Robustness Checks

Methodologically, our use of the Poisson pseudo-maximum-likelihood estimator follows the literature that suggests that this estimator is the most appropriate for the case at hand (Silva and Tenreyro 2006). Others have argued that in trade/investment models, large numbers of zeros may pose greater challenges than the heteroskedasticity of errors so that, under certain conditions, it may be preferable to use tobit or even OLS (Martin and Pham 2011) or modified Poisson fixed-effects estimators, such as the zero-inflated Poisson (Burger et al. 2009).[21] To check the robustness of our results, we complement Poisson regressions with tobit, zero-inflated Poisson, and OLS regressions. The results, reported in table A.2 in the online appendix, are in line with previous reports, allaying fears that our findings are driven by the choice of estimator. Coefficients for the main variables of interest are comparable to those obtained previously, supporting the importance of bilateral factors, such as distance or colonial relationships, supply factors linked to agro-ecological potential, and, to some extent, food exports, demand shifters such as net food imports and population, and land governance rather than investor protection or a general rule of law index as a key institutional factor.

Conclusion and Policy Implications

Higher commodity prices and concerns about food security, a history of underinvestment in agriculture, and wide variation in land scarcity and productivity

21. The zero-inflated models assume the existence of two latent groups within the population: one with zero counts and one with only positive counts. They are then estimated in two steps. A first step uses a logit regression to estimate the probability that there is no bilateral investment at all, and a second step is a Poisson regression of the probability of each count for the group with a non-zero probability.

across countries have considerably increased interest by investors in agricultural land. Conceptually, it seems desirable for countries subject to such interest to adopt policies that encourage "pioneer" investors but to keep out speculators (Collier and Venables 2011). However, little systematic evidence or data exist to concretize such guidance.

To advance this issue, we document available data, noting that limitations allow only crude inferences of interest in the number of projects involving land acquisitions at the country level rather than actual transfers. The use of different databases allows us to discern a boom-bust cycle associated with the 2007–8 commodity price spike, a strong focus of new interest on Africa, and distinct differences in the profile of transactions across regions with much greater state involvement in Africa than elsewhere. However, available databases suffer from common gaps and weaknesses that will have to be addressed on a priority basis to make reliable inferences on land sizes, proposed investment volumes and job creation, business models (outgrower or nucleus, greenfield or takeover of an existing farm), and implementation progress in a consistent and meaningful way. Without these inferences, it will be difficult not only to dispel the air of secrecy currently surrounding this topic but also to allow countries and investors to draw lessons from successful (and unsuccessful) experiences to develop appropriate business models and approaches over time.

Combining evidence on land demand by outsiders with country-level endowments allows econometric analysis to identify the drivers of this demand. Beyond bilateral links (distance, cultural proximity), the potential availability of hitherto uncultivated land and a history/infrastructure of food exports are relevant, as are food import dependence and population as demand factors. The insignificance of the "yield gap" and the consistent association of weak land governance with higher investor interest are surprising but are in line with the notion that, in our study period dominated by the immediate post-2008 peak, interest may have been focused more on the acquisition of "vacant" land rather than on helping improve agricultural productivity by integrating existing producers into value chains. This notion is in line with anecdotal evidence of countries that attracted large amounts of investor interest at the peak but found it difficult to translate investors' promises into production or benefits on the ground. This finding suggests that attracting high levels of diffuse interest by players who lack familiarity with the sector may not be conducive to quickly advancing agricultural productivity for the benefit of broader development and, if it leads to tracts of land being occupied without utilization, may actually be detrimental to this goal.

Although our data are too weak to make inferences on actual production, our evidence implies that better land governance,[22] increased transparency, and a more consistent global and national effort at monitoring could be conducive to

22. In line with international agreements (Food and Agricultural Organization of the UN 2012), these could include recognition of local rights, education of rights holders, and allowing voluntary and transparent transfers of land.

attracting capable investors in a number of ways, particularly by (i) improving the ability to identify responsible and qualified investors *ex ante* and to effectively negotiate with them to maximize local benefits by integrating existing producers into value chains; (ii) ensuring that land occupied by non-viable ventures can be transferred to more efficient producers quickly; (iii) allowing responsible investors to distinguish themselves to reduce risk and, ideally, their cost of capital; and (iv) providing a basis for learning from experience to develop successful business models. The recent slow-down of the "land rush" provides an opportunity for countries to act on this agenda now so they can be in a better position to distinguish pioneers from speculators and can thus turn mere interest into real progress for the agricultural sector if and when another commodity price boom hits.

Postscript

Following acceptance of this article, the Land Matrix Global Observatory has informed the authors of a comprehensive re-launch of their database in June 2013 which now provides improved information on data sources, dates, implementation status and sizes of intended, contracted, and failed land projects. Together with updates, e.g. on the type of investor and seller, envisaged in the future, this is expected to address many of the concerns raised in this article. Readers are encouraged to access the most recent version of the data at http://landmatrix.org/

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