

Landscape: statistical evidence of tenure risk

Correlations between tenure disputes and geospatial indicators showing environmental, social and governance conditions

TMP Systems

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Landscape version 4.2

This document describes statistical evidence for tenure risk that has been developed by TMP Systems, following a systematic analysis of available environmental, social and governance data.

‘Tenure risk’ is a term we created to describe the financial risk associated with local opposition to a real asset. This kind of opposition to investments is very common across Africa, Asia and Latin America, often causing significant financial losses and operational headaches.

The statistical analyses summarized in this paper provide the underpinnings for assessments of operational risk at a micro scale, providing local-level granularity to risk assessment.

1. Executive Summary

This report explains TMP Systems' statistical analysis of how geospatial data showing indicators of local environmental, social and governance (ESG) conditions correlate with tenure risk.

The results indicate strong enough correlations between some of these indicators and tenure risk, to support use of the indicators by companies and investors. This work underpins something new and useful, which is Landscape's ability to provide location-specific risk assessments across many developing countries.

We arrived at these conclusions by analyzing ESG indicator data for locations where reports suggested that projects were impacted by tenure risk (dispute locations), and comparing that to project locations without such reports (control locations). This involved two analyses, one of national-level indicators that return the same score for any location within a country, and another of local-level indicators, which vary across different sites within a country.

The subnational indicator analysis revealed statistically significant correlations with several ESG factors at the local level, notably:

- **Poverty.** Higher levels of certain localized poverty indicators are associated with tenure disputes, and broader poverty measures are also correlated with tenure risk.
- **Demographics.** Population change is associated with the incidence of tenure disputes, with faster rates of population growth strongly associated with tenure risk.
- **Political power.** Areas where ethnic groups have limited access to political power are strongly associated with tenure disputes. We also saw significantly higher incidence of disputes where more groups are excluded from national executive power.
- **Environmental protection.** Locations with more protected land are associated with tenure disputes. The presence of protected areas correlates with higher risks of disputes with local populations living and using the land nearby a project.
- **Land use change rates are associated with tenure disputes,** in that areas with tenure risk typically had higher levels of change in vegetation cover.

At a national level, we found statistically significant correlations between tenure disputes and several indicators, confirming previous findings of our own and others' research into tenure risk. Specifically:

- **Governance.** Lower quality regulation and weaker government capacity increase tenure risk. These two governance indicators showed the strongest relationships with tenure disputes, and several others had some relationships, as discussed below.
- **Poverty.** Higher levels of poverty at the national level increase tenure risk. Worse Human Development Index¹ scores are strongly associated with tenure disputes.

¹ United Nations Development Program (2018), "Human Development Indices and Indicators: 2018 Statistical Update," United Nations Development Programmed: New York. <http://hdr.undp.org/en/content/human-development-index-hdi>

It bears repeating a standard warning: correlation is not causation. Nothing in the data we have analyzed to date would support the conclusion that things like poverty, land use change or corruption cause assets to encounter tenure risk.

Rather, it appears that those conditions exist in greater measure where tenure risk has been a problem. The following pages describe how we reached that conclusion.

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2. Introduction

Landscape is a system for measuring tenure risk, a term TMP Systems created to describe the financial risk associated with local opposition to a real asset. This kind of opposition to investments is very common across Africa, Asia and Latin America, often causing significant financial losses and operational headaches.

This document describes the results of our efforts to quantify tenure risk. Through this work, we have developed empirical evidence that certain national and local ESG conditions show statistically significant correlations with the incidence of tenure disputes. This context is increasingly measurable at a highly localized scale, allowing geographically specific assessments of ESG risk that have not previously been possible.

Some background information will be of use. Over the last seven years, we have compiled a database of more than 600 tenure disputes, each studied in detail to inform the development of Landscape. We have developed a strong qualitative understanding of why tenure disputes arise, and what ESG factors contribute to them.

This has been useful in advancing the work of a number of companies and investors to improve their risk management, but still falls short of the kind of quantitative certainty seen in more traditional forms of risk analysis. Specifically, we have a limited understanding of the extent to which these factors contribute to the risk of a dispute, and under what conditions.

We believe that the information shared below breaks through that barrier, and will interest investors and companies alike. This is because tenure disputes can have significant operational and financial impacts on assets, and have gained attention from corporations, governments and activists over recent years as the result of highly publicized scandals and project failures.

The evidence set out below gives the basis for Landscape's automated ESG risk assessment methodology. That methodology results in a rating of the similarity between the locations being queried, and the locations of known tenure disputes, drawn from The TMP Tenure Dispute Database.² This in turn provides users with the means to judge the relative riskiness of the projects and places in which they are interested.

Our results, and Landscape itself, are a first step in allowing companies and investors to combine an empirical approach to ESG risk with existing quantitative valuation and risk management processes. To clarify how we took this step, the paper is divided into two sections: the first describes our analytical methods and the second gives the results of our analysis.

² The TMP Tenure Dispute Database records projects that were subject to a dispute between a company and people local to the project area concerning the use of land or other natural resources. This database is growing: the results presented in this paper are based on version 2018.3, containing 584 cases. The latest update, v2019.1, has 602 cases and is available for download from the Landscape website: <https://landscape.info/about.php>.

3. Methodology

Data availability

Our previous qualitative work suggested three things about tenure risk. First, tenure disputes seemed to be more common in places with difficult environmental, social and political factors, but it did not seem possible to pin them to any single one of those categories. We interpreted this to mean that we should try to understand it as a socio-political phenomenon.

Second, it seemed to be highly localized, less associated with specific countries than with specific locations. We took this as a sign that we should prioritize understanding local conditions.

Third, it seemed to happen at a global scale, one large enough where we could draw some statistical conclusions from a reasonable sample size of incidents. This suggested an approach that analyzed assets in places with reports of tenure disputes, in comparison to places where no such reports were found. And indeed, that is what we decided to try doing.

To create that comparison, we systematized our Tenure Dispute Database³ to provide a sample of cases that we could use to interrogate whatever datasets we found. Once that was completed, we set about finding geospatial data showing indicators of ESG factors, attempting to find them in the highest resolution possible.

We quickly realized that, whereas there are datasets showing local conditions across the environmental and some of the social category, information on political conditions is almost wholly national-level – that is, indicators that apply a single score to an entire country.

Globally available data on many environmental and social factors offers various degrees of specificity, from administrative units (say, district level) down to the micro-level (such as the 300m x 300m GlobCover datasets). In the analysis of environmental and most social data, this meant that we were able to make use of binomial regressions to compare locations with reported tenure risk problems to locations without similar reports.

The sample of cases for testing was taken from palm oil projects in the TMP Tenure Dispute Database, which could be compared against a control group of palm oil projects without reported disputes; both populations cover a diverse spread of global emerging markets. We then used a separate set of hydropower project cases, a sector for which there was also a set of non-dispute project locations available for comparison, to validate the results.

The same approach could not be taken to testing governance and poverty indicators. The only globally comparable, high quality, quantitative assessments of governance are all resolved at the national level. Poverty data also suffers from a partial absence of comprehensive, global, sub-national-level data, meaning that we needed to add national poverty indicators to our subnational analyses.⁴

³ The TMP Tenure Dispute Database (v2019.1) provides details on 602 cases of tenure dispute from across the world, with a particular focus on emerging markets. For the analysis presented in this paper, we used version 2018.3.

⁴ The Multidimensional Poverty Index dataset provides subnational, comparable data, but currently covers only 105 countries, leaving a significant data gap including certain key emerging markets such as Russia and South Africa.

All of this demanded a slightly different approach for the national-level datasets, in that we drew on the entire set of case studies available in the Tenure Conflict Database in order to maximize the statistical power of the analysis. This included cases from all sectors where tenure disputes had occurred, with the ultimate unit of analysis being the number of cases in a given country per US dollar of FDI (\$FDI). The nature of the resulting datasets enabled us to draw linear regressions comparing the number of tenure conflicts for a number of countries against each of the indicators.

We describe the data and methods involved in each set of analyses in more detail below, and the key results in Sections 5 and 6.

Indicator selection

As mentioned above, previous qualitative analyses of case studies of tenure risk, and our own assessments of the contexts surrounding them, indicate that a number of ESG factors are important in triggering or amplifying their impact.^{5, 6} This section provides a brief explanation of those indicators, and our initial hypotheses of their relevance to tenure risk. In all cases we selected indicators from reliable sources that had strong methodologies for data selection and verification (such as transparent, clear criteria for inclusion, and publication in peer-reviewed journals).

Environmental

Our previous review of case studies indicated that environmental damage is the second-most common driver of tenure disputes (seen in 44% of cases) after forced displacement; shortage of natural resources is the third-most common (in almost a third of cases).

This suggested that places where the environment is sensitive or where natural resources are scarce may be more prone to tenure disputes. We selected indicators that might reflect these realities from public sources, as shown here.

Our statistical analysis investigated three major aspects of the environmental context that affect the availability and quality of land and natural resources: water, land use, and soil health. Granular geospatial data with global coverage exists for information points related to each of these factors, allowing us to assess them at the subnational level. So, for each

5 These analyses tend to focus on particular sectors or regionally-specific topics. See e.g.:

Franks, Daniel M., Rachel Davis, Anthony J. Bebbington, Saleem H. Ali, Deanna Kemp, and Martin Scurrah (2014), “Conflict Translates Environmental and Social Risk into Business Costs.” *PNAS*, 111 (21): 7576–81;

Kirchherr, Julian, Katrina J. Charles, and Matthew J. Walton, (2016), “Multi-Causal Pathways of Public Opposition to Dam Projects in Asia: A Fuzzy Set Qualitative Comparative Analysis (FsQCA).” *Global Environmental Change* 41: 33–45.

6 Our most recent analyses covered sub-Saharan Africa and Southeast Asia. See: TMP Systems, (2016), “Tenure and Investment in Africa: Comparative Analysis of Key Trends and Contextual Factors.” http://rightsandresources.org/wp-content/uploads/2017/01/Tenure-and-Investment-in-Africa_Trend-Analysis_TMP-Systems-RRI_Jan-2017.pdf; TMP Systems, (2017), “Tenure and Investment in Southeast Asia: Comparative Analysis of Key Trends.” <http://rightsandresources.org/wp-content/uploads/2017/09/TMP-SEA-Key-Trends.pdf>

environmental indicator, we can develop reasonable, testable hypotheses about their relationship with tenure conflicts.

Dataset	Version	Provider
Aqueduct Global Maps ⁷	2.1	World Resources Institute
GlobCover ⁸	2.2	European Space Agency
GlobCover ⁹	2.3	European Space Agency
Harmonized World Soil Database ¹⁰	1.2	IIASA, FAO, ISRIC-World Soil Information, European Soil Bureau Network, Institute of Soil Science (Chinese Academy of Sciences)
World Database of Protected Areas ¹¹	Sept 2018	United Nations Environment Program and International Union for the Conservation of Nature

Table 1. Environmental datasets used in the analysis

Governance

As already mentioned, good quality indicators of governance conditions are only available at national-level resolution. But research shows that weak governance, regulation and enforcement; corruption; and repression frequently contribute to tenure disputes.¹²

The qualitative evidence that they are important in tenure risk means that we needed to include some measure of these factors in our methodology. We focused on seven indicators drawn from two datasets: the six indicators of the Worldwide Governance Indicator (WGI) dataset produced by the World Bank, and the Corruption Perceptions Index released by Transparency International.

Dataset	Version	Provider
Worldwide Governance Indicators ¹³	2017	World Bank
Corruption Perceptions Index ¹⁴	2017	Transparency International

Table 2. Governance datasets used in the analysis.

7 Gassert, F., M. Landis, M. Luck, P. Reig, and T. Shiao (2014), “Aqueduct Global Maps 2.1.” Working Paper. Washington, D.C.: World Resources Institute

8 Arino O., M. Leroy, F. Ranera, D. Gross, P. Bicheron, F. Niño, C. Brockmann, P. Defourny C. Vancutsem, F. Achard, L. Durieux, L. Bourg, J. Latham, A. Di Gregorio, R. Witt, M. Herold, J. Sambale, S. Plummer, J.-L. Weber, P. Goryl, N. Houghton (2007), ‘GlobCover: ESA service for Global Land Cover from MERIS’. International GeoScience and Remote Sensing Symposium (IGARSS), Barcelona, Spain.

9 Arino O., J. Ramos, V. Kalogirou, P. Defourny and F. Achard (2010), ‘GlobCover 2009’. ESA Living Planet Symposium, 27 June - 2 July 2010, Bergen, Norway

10 FAO/IIASA/ISRIC/ISSCAS/JRC (2012), Harmonized World Soil Database (version 1.2). FAO, Rome, Italy and IIASA, Laxenburg, Austria.

11 UNEP-WCMC and IUCN (2016), Protected Planet: The World Database on Protected Areas (WDPA) [Online], Accessed September 2018. Cambridge, UK: UNEP-WCMC and IUCN

12 See, for example, Kircherr et al (2016).

13 Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi (2010), “The Worldwide Governance Indicators: Methodology and Analytical Issues.” Policy Research Working Paper 5430. The World Bank, Development Research Group, Macroeconomics and Growth Team. The WGI dataset is available at: <http://info.worldbank.org/governance/wgi/#home>

14 Corruption Perceptions Index (2017) by Transparency International, licensed under CC-BY-ND 4.0. Available at: https://www.transparency.org/news/feature/corruption_perceptions_index_2017

Social indicators

There is compelling qualitative evidence that the local social context contributes to tenure-related project disruptions. Studies conclude that the most common issues underlying mining disputes relate to social and economic factors,¹⁵ while an analysis of hydroelectric projects identified a lack of social safeguards as a necessary condition for project opposition.¹⁶

Our analysis investigated three factors that have a critical impact on social context at the local level: conflict, poverty, and demographics. There is granular subnational data for each of these, allowing comparisons within countries as well as between them, and permitting us to test specific hypotheses about how tenure risk might be affected by each indicator.

Dataset	Version	Provider
Armed Conflict Location & Event Data Project¹⁷	3 Sept 2018	Armed Conflict Location & Event Data Project
Gridded Population of the World Population density¹⁸ Population count¹⁹	4	Columbia University
Human Development Index²⁰	2018	United Nations
Multidimensional Poverty Index²¹	Winter 2017/2018	University of Oxford
Social Conflict Analysis Database²²	3.3 (2017)	University of Texas, University of Denver, William & Mary, University of North Texas
Uppsala Conflict Data Program Georeferenced Events Database²³	18.1	Uppsala University

Table 3: Social datasets used in the analysis

15 Franks et al (2014)

16 Kirchherr et al (2016)

17 Raleigh, Clionadh, Andrew Linke, Håvard Hegre and Joakim Karlsen. (2010). "Introducing ACLED-Armed Conflict Location and Event Data." *Journal of Peace Research* 47(5) 651-660.

18 Center for International Earth Science Information Network - CIESIN - Columbia University (2016), Gridded Population of the World, Version 4 (GPWv4): Population Count. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). <http://dx.doi.org/10.7927/H4X63JVC>.

19 Center for International Earth Science Information Network - CIESIN - Columbia University (2016), Gridded Population of the World, Version 4 (GPWv4): Population Density. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). <http://dx.doi.org/10.7927/H4NP22DQ>

20 United Nations Development Program (2018), "Human Development Indices and Indicators: 2018 Statistical Update". United Nations Development Program: New York.

21 Alkire, S. and Kanagaratnam, U (2018), 'Multidimensional Poverty Index - Winter 2017-18: brief methodological note and results'. OPHI MPI Methodological Notes No. 45, Oxford Poverty and Human Development Initiative, University of Oxford.

22 Salehyan, Idean, Cullen S. Hendrix, Jesse Hamner, Christina Case, Christopher Linebarger, Emily Stull, and Jennifer Williams (2012), "Social conflict in Africa: A new database." *International Interactions* 38, no. 4 (2012): 503-511

23 Sundberg, Ralph, and Erik Melander (2013), "Introducing the UCDP Georeferenced Event Dataset", *Journal of Peace Research*, vol.50, no.4, 523-532. Croicu, Mihai and Ralph Sundberg (2017), "UCDP GED Codebook version 18.1", Department of Peace and Conflict Research, Uppsala University

Analysis

Subnational data

Our analysis of subnational datasets compared indicator values in places where tenure disputes had disrupted projects ('dispute locations') against project locations where tenure disputes were not known to have happened ('control locations').

We started by testing locations from a single sector, since this would reduce the number of potential external variables related to the business model, which might skew results. In direct response to requests from investors and companies, we chose projects from the palm oil sector, querying a publicly-available dataset of mills ('WRI Mills') as the control group and comparing it to palm oil disputes from the Tenure Conflict Database.²⁴

To compose the control locations, we removed from the mill dataset all areas covered by cases from the Tenure Disputes Database, in order to produce our control dataset of locations without known tenure problems. The control dataset was thus made up entirely of palm oil mill locations where no conflict was known to have occurred.

We used extracted data for a 'buffer zone' around each location (a circle with a radius 50km, as the people involved in palm oil disputes tend to live and work within this range) to develop a statistical profile of the indicators that we could compare. We extracted indicator values for three environmental factors (water, land use and soil health) and four social factors (poverty, population levels, ethnicity and conflict). We calculated mean average figures for poverty, water risk and soil indicators, and total figures for population, conflict, land use classifications, and land under Protected Area status.

Following the palm oil analysis, we conducted a 'sense-checking' exercise in which we used a simple replication of these tests using hydropower project and dispute locations, to confirm that the results we were seeing were applicable to tenure disputes more broadly. All of the observed relationships from the palm oil analysis were corroborated by this exercise, except where explicitly noted in the Results section below.²⁵

National-level data

We have not yet found good quality global data on the number of private-sector real assets projects, to serve as a control group for comparison against the Tenure Disputes Database. We therefore had to approach the national-level indicator analysis differently, using a proxy that would give a sense of how frequently tenure conflicts occurred in proportion to the amount of relevant economic activity.

Foreign direct investment in a country provides a good proxy for two reasons. First, in most emerging markets, the majority of inbound investment typically involves real assets that

²⁴ The 'control' palm oil mill dataset was generated from the World Resources Institute's database of palm oil mill locations, with full details available at: <http://data.globalforestwatch.org/datasets>. The latest version of the TMP Tenure Dispute Database is available to download from the Landscape website, at <https://landscape.info/about.php>

²⁵ The results of the full version of these analyses, and those for other relevant sectors where appropriate 'control' project data is available, will be described in future updates to this paper.

require some land and other natural resources to operate. Second, while tenure disputes certainly do occur around projects supported by domestic capital, internal investment levels tend to track fairly closely with foreign direct investment. We therefore used the number of tenure conflict cases per US dollar of foreign direct investment (\$FDI) over the period as our control measure.²⁶

To get a broad sense of tenure risk at the national level, we looked at the number of tenure dispute cases per country in the period covered by poverty and governance data, using a subset of 502 cases from the Tenure Dispute Database during this period (1996-2016).

For each known dispute in our database, this calculation involved averaging the amount of annual foreign direct investment in a given country for the two years preceding each conflict and the year of the conflict. The resulting values were then averaged at the country level, to provide the \$FDI per annum for each country, for all the years relevant to the tenure disputes which had occurred in it. We then used the number of tenure disputes that had occurred per \$FDI as our unit of analysis.

The resulting dataset of tenure conflict cases per \$FDI in 86 countries was then compared against seven governance indicators and one poverty indicator. For governance, we used the six indicators of the Worldwide Governance Indicator (WGI) dataset produced by the World Bank, and the Corruptions Perceptions Index score (produced by Transparency International).

The six WGI indicators are: Control of Corruption; Government Effectiveness; Political Stability and Absence of Violence; Regulatory Quality; Rule of Law; and Voice and Accountability. These indicators capture a broad spectrum of political and governance conditions at the country level, and offer the advantage of providing a long time-series of data, from 1996 to 2016. The Corruptions Perceptions Index offers a useful point of comparison to the Control of Corruption metric, and covers a similar time period.

For poverty, we used the Human Development Index (HDI) scores provided by the United Nations Development Program, to provide a level of global assessment that is unavailable using the MPI (see pages 23-24). The HDI provides a holistic measure of poverty including health, education and living standards, and which covers the same period as the WGI.

We first assessed the normality of each dataset using the Shapiro-Wilk normality test and visual assessment of Q-Q plots²⁷ to determine what analytical techniques were appropriate. We found that the governance and poverty indicator data followed a normal distribution, but the tenure conflict data does not, so we applied a log-transformation to the tenure conflict data.

Each indicator was tested for a correlation with the number of cases per \$FDI. This was done using Spearman's test, returning a value between -1 and 1. This test provides an indication of whether there is a statistically significant relationship between the two variables, and the

²⁶ Running the same analyses but normalizing against GDP did not reveal significant differences, suggesting that alternative economic measures are unlikely to offer any improvement in accuracy.

²⁷ Ghasemi and Zahediasl (2012), "Normality Tests for Statistical Analysis: A Guide for Non-Statisticians." International Journal of Endocrinology and Metabolism 10 (2): 486-89.

strength of that relationship. The closer to 1 or -1 the value is the more likely it is that there is a monotone relationship between the two variables.²⁸

The p-value in the test is testing against the null hypothesis that Spearman's test will return 0 – i.e. that there is no correlation between the variables. All indicators apart from Political Stability and Absence of Violence showed a monotonic relationship with tenure conflicts – we provide a full summary in Section 6.

²⁸ For more information, see: <https://statistics.laerd.com/statistical-guides/spearmans-rank-order-correlation-statistical-guide.php>

4. Results: sub-national indicators

Environmental

Water

The Aqueduct dataset has near-global coverage, and provides subnational data on a range of water metrics at the resolution of major river basins.²⁹ The eight Aqueduct indicators that we considered in the analysis measure risks that water issues will negatively impact users.³⁰ For each indicator, we used Aqueduct’s normalized values, which range from 0 (very low risk) to 5 (extremely high risk).

Hypothesis: We expected greater absolute levels of risk in each indicator to correspond with increased levels of tenure risk. Grievances over water are commonly cited in tenure disputes. Projects in agriculture, extractives, and hydropower (66% of the Tenure Disputes Database) – significantly effect local water supply. It is logical to assume that places with a more precarious water situation will be more prone to the effects, and feel them more acutely.

Analysis: We compared indicator values in places where tenure disputes had occurred over a project (‘dispute locations’) against projects without known tenure issues (‘control locations’).

Results: We found no statistically significant relationship between the occurrence of tenure conflicts and water risk levels for all but two indicators.

The exceptions were Flood Occurrence (indicating the number of floods recorded in a catchment between 1985 and 2011) and Seasonal Variability (the risk that water supply varies dramatically between seasons). However, the relationship we found was negative, tenure disputes occurred in places that had experienced significantly *fewer* floods than the control locations.

Figure 1 shows the average and range of scores. There is significant covariance between Seasonal Variability and Flood occurrence, as flooding often results from relatively sudden downpours typical of highly seasonal rainfall patterns.

Conclusion: Further testing for additional sectors has so far failed to corroborate this correlation, so the indicator is not used in the overall tenure risk model for Landscape v4.2.

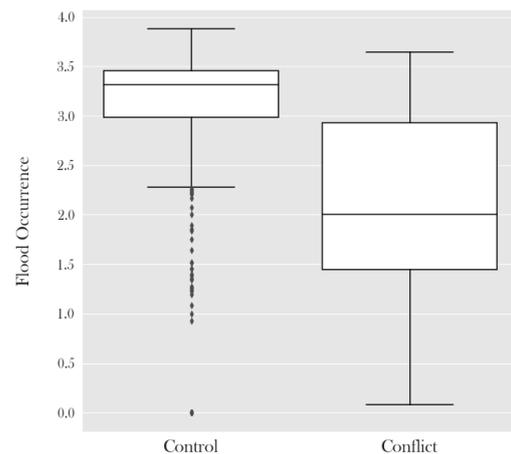


Figure 1: Flood occurrence risk values in control and dispute locations

29 Gassert, Francis, Matt Landis, Matt Luck, Paul Reig, and Tien Shiao (2014), “Aqueduct Global Maps 2.1.” World Resources Institute. Available at: <https://www.wri.org/publication/aqueduct-global-maps-21>

30 The eight indicators are: Baseline water stress, Interannual variability, Seasonal variability, Flood occurrence, Drought occurrence, Groundwater stress, Return Flow Ratio, and Threatened Amphibians.

Soil

The analysis looked at soil ph levels, soil organic carbon, and soil sodicity.

Hypothesis: Our initial hypothesis was that poorer soil quality would be associated with increased levels of tenure disputes.³¹

The quality and location of alternative land awarded to displaced communities is a frequent source of tension in tenure disputes, so was that lower availability of good quality land would increase the likelihood of tenure disputes, as there would be fewer alternatives for local people facing displacement by projects.

Analysis: We compared soil health indicator values in places where tenure disputes had occurred over a project (‘dispute locations’) against project locations where tenure disputes were not known to have occurred (‘control locations’).

Results: The results of our analysis of soil quality suggested no statistically significant link between soil health (good or bad) and tenure conflicts (see Figure 2 for an example showing soil organic carbon levels between the two groups).

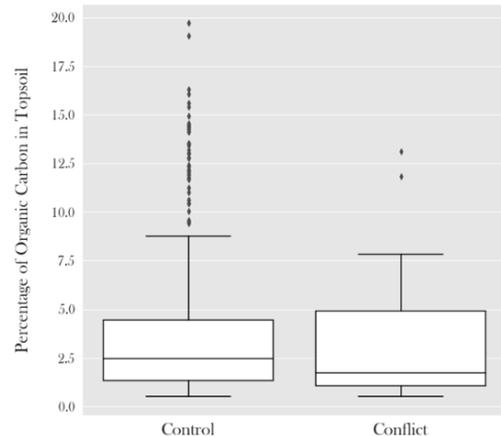


Figure 2: Percentage of soil organic carbon in topsoil in control and dispute locations

Land cover change

We compared changes in land cover between two versions of the GlobCover dataset, which categorizes land cover according to 22 classes defined by the UN. The two versions are 2.2 (covering the period 2005-2006) and 2.3 (2009).³²

Hypothesis: Places undergoing greater overall change in land cover would see greater levels of tenure conflict.

The amount of change that a landscape has seen can be viewed as a proxy for the amount of pressure there is on the availability of land. We might expect that places seeing rapid or large-scale changes in land use would be more prone to tenure disputes, as the landscape is already undergoing significant changes that affect local peoples’ access to and usage of land.

Analysis: We compared land use change values in places where tenure disputes had occurred over a project against control locations.

³¹ Alternatively, we might hypothesize that projects located on land with particularly good soil quality might be more prone to conflict, as people on prime agricultural land would be particularly reluctant to leave.

³² The majority of the tenure conflicts we examined lie in the years between these datasets, or within three years of this range. Land use change as represented by these datasets – like water or poverty conditions – is therefore assumed to be broadly representative of conditions in a given area over time. We are conducting further testing with alternative datasets that provide greater temporal coverage to further test these results.

Results: We found that the mean and median total change in land cover types were greater in places where tenure conflict had occurred than in the control group, as shown in Table 4 below.

Indicator	Group	mean	median
Total percentage change (v2.3 - v2.2)	Control	-2.23659	-1.845
Total percentage change (v2.3 - v2.2)	Conflict	-2.74344	-2.145

Table 4: Mean and median total percentage change in land cover classes in conflict and control locations, 2005/6 to 2009

We further found that the difference was statistically significant. The results of the Mann-Whitney Test are summarized in Table 5 below. Because the p-value is less than 0.5, we were able to reject the null hypotheses and conclude that there was a statistically significance significant difference at a 95% confidence level.

Indicator	Mann-Whitney p-value
Total percentage change (v2.3 - v2.2)	0.040948

Table 5: Significance of the difference in average land use change between control and dispute locations

Conclusion: These results suggest that the general extent of land use change in an area is associated with the incidence of tenure conflicts in that area. Further research is needed to explore the nature of this relationship.

Protected areas

Using data from the World Database of Protected Areas, we calculated the area covered by designated Protected Areas within each buffer zone. We did not differentiate between different types of protected area because of limited data completeness for this variable.

Hypothesis: Tenure dispute locations would have larger coverage of protected areas than places without documented tenure conflicts.

Any restriction on the types of economic activity allowed is likely to have an effect on land availability, and thus increase the likelihood of disputes over projects that further decrease the availability of land. Protected Areas may in restrict economic activity, as well as providing legal protections around the use of natural resources, which may exacerbate disputes.

Analysis: We compared the quantity of nearby land covered by Protected Areas in dispute locations against control locations.

Results: Our analysis showed that the area covered by Protected Areas³³ was a significant predictor of tenure risk. As Figure 2 shows, dispute locations typically included a much greater coverage of Protected Areas within the 50km buffer than control locations.

³³ The boxplot describes this as “Protected Areas (km²)”. This refers to the areal extent of the protected area in according to the geospatial data and analytical tools that we used.

The differences between dispute locations and our control group are striking. Control locations rarely had more than 6% of nearby land covered by Protected Area status, and never more than 25% coverage. A quarter of dispute locations, however, had over 30% Protected Area coverage of nearby land.

Table 6 below shows that these differences were found to be statistically significant, with the p value of the Mann-Whitney U test well below the 0.05 threshold for a 95% confidence level.

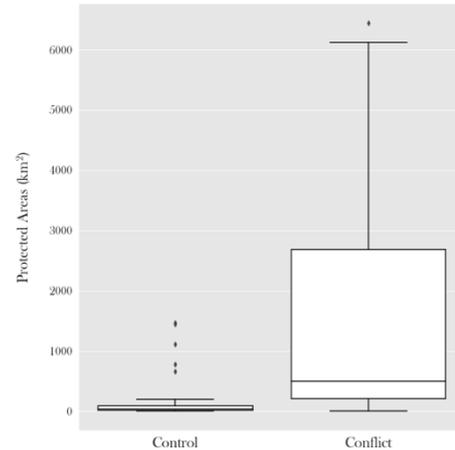


Figure 3: Area covered by Protected Areas in control and dispute locations

Indicator	Mann-Whitney U test p-value
Protected Area coverage (square kilometers)	0.00000000005280

Table 6: Significance of the difference in average land use change between control and dispute locations

Conclusion: It may be that Protected Areas constrict land availability and increase competition; or that environmentally or culturally sensitive landscapes have legal protections that affected communities can lever in disputes. Regardless of the cause, the risks that projects will run into conflict with local communities is significantly higher in these locations.

Social

Conflict events

We analyzed the total number of conflict events from the ACLED database within each buffer zone. Dispute and control locations in Costa Rica, Columbia, Papua New Guinea and Malaysia were excluded from this part of the analysis as these countries are not covered by the ACLED dataset.

Hypothesis: Places that have seen more political conflict events are more likely to be subject to tenure disputes than places that have not.

This is based on the observation that a number of ESG factors linked to tenure conflicts also appear to be related to armed conflicts.³⁴ It is therefore intuitive to suppose that locations that are witness to other types of conflict are also likely to be more prone to tenure disputes.

³⁴ For example, studies have pointed to the relationships between conflict and water, inequality, population / demography, and food security. See: Pacific Institute. (n.d.) “Water Conflict.” Available at: <https://www.worldwater.org/water-conflict/>; PRIO (2017), “Inequality and Armed Conflict: Evidence and Data.” Available at: <https://www.prio.org/Publications/Publication/?x=10538>; SIDA (2018), “The Relationship between Climate Change and Violent Conflict.” Available at: <https://www.sida.se/contentassets/c571800e01e448ac9dce2d097ba125a1/working-paper---climate-change-and-conflict.pdf>; or FAO (2017), “Conflict Causing Spikes in Food Insecurity in the Near East and North Africa.” Available at: <http://www.fao.org/news/story/en/item/1073611/icode/>

Analysis: We compared the total number of conflict events from the ACLED database in places where tenure disputes had occurred over a project (‘dispute locations’) against project locations where tenure disputes were not known to have occurred (‘control locations’).

Results: We found a significant association between places with a history of conflict and dispute locations. On average, places where tenure disputes had occurred were witness to over 100 events of violent conflict, while places with no evidence of tenure dispute saw less than 1. Figure 3 provides illustrates the differences between the two datasets.

However, in subsequent testing of correlations in the hydropower sector, we were not able to replicate the findings, suggesting that further investigation is needed.

Conclusions: These results suggest that the indicator is not suitable for use in a general tenure risk model. Further analysis of new datasets of palm oil mill locations may confirm whether the results are useful in a model that is specific to palm oil.

Relative MPI

We assessed a composite metric of poverty – the Multidimensional Poverty Index (MPI) – which combines an indicator of the proportion of people in poverty with the intensity of deprivation suffered by those people. The MPI dataset provides sub-national data for 105 countries, alongside comparable national values.

For each location in the conflict and control locations for which MPI data is available, we computed the ratio of the local MPI value to the national average value, providing a ‘Relative MPI value’.

Hypothesis: Our hypothesis was that tenure disputes would occur more in places where people are poorer than the national average.

As shown in our results at the national level, absolute poverty levels show an association with tenure conflicts. We wanted to explore whether higher *relative* poverty levels – comparing local levels to the national average – would associate with higher levels of tenure conflict.

Analysis: We compared Relative MPI values in places where tenure disputes had occurred over a project (‘dispute locations’) against project locations where tenure disputes were not known to have occurred (‘control locations’).

Results: As Figure 4 illustrates, the median relative poverty levels in tenure dispute locations are higher than in places where disputes have not been documented. In mean terms, local poverty levels were 1.05 times that of the national value in the control group, but 1.36 times national levels in places where tenure disputes have occurred.

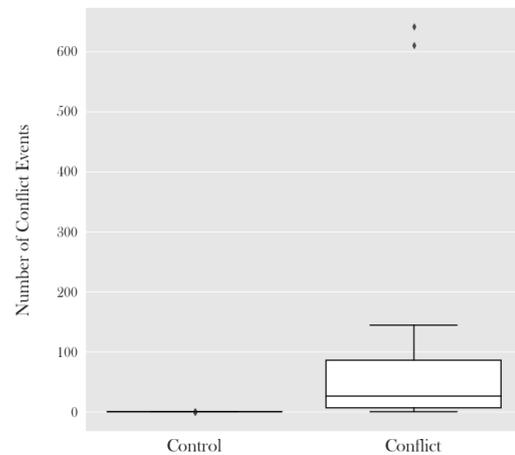


Figure 4: Total conflict events from the ACLED database recorded in control and dispute locations

Conclusions: The results indicate that the number people who are poor, and the intensity of their deprivations, *relative to the national average levels of deprivations*, affect the likelihood of tenure dispute. Further work to see whether relative levels in component indicators of the MPI show this trend would be instructive in improving our understanding of the dynamics, as would analyzing national poverty levels relative to regional averages.

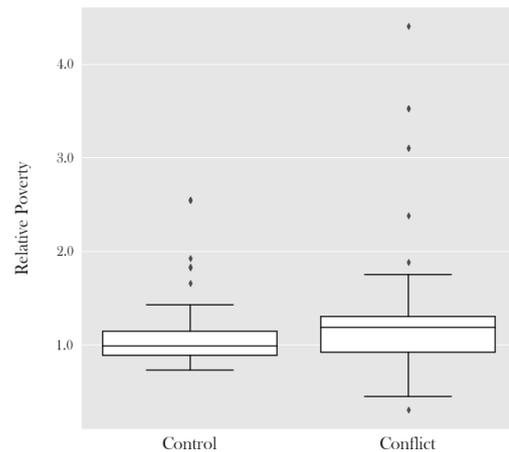


Figure 5: Relative MPI (local to national) values in control and dispute locations

Multidimensional Poverty Index – Component indicators

There are ten different indicators of deprivation measured by the MPI, in three groups: health, education and living standards. The MPI dataset provides the average intensity (number of deprivations) suffered by people in an area and the proportion of people in multidimensional poverty. It also measures the proportion of people suffering different levels of deprivation.

We assessed absolute levels for what proportion of people living in the buffer zone were and deprived in each of the ten component indicators of the MPI, as well as values for additional compound metrics such as ‘vulnerability to poverty’ (the proportion of people deprived in 20-33% of component indicators), ‘in severe poverty’ (percentage of population deprived in more than 50% of component indicators) and ‘inequality among the poor’ (a measure of how much variation in poverty scores there were among poor people).³⁵

Hypothesis: For each MPI indicator, we expected higher levels of deprivation in dispute locations compared to the control locations.

Each indicator appears to be a plausible factor in driving tenure dispute. Given the findings of our research at the national level, we explored how the various MPI sub-indicators and composite metrics associated with tenure risk.

Analysis: We compared the absolute values of each indicator in dispute locations against the values for control locations. We confirmed that the samples were not normally distributed by calculation of the Shapiro-Wilk test statistic, and used non-parametric testing – the Mann-Whitney-U test – to compare the two data sets.

³⁵ The full description of these indicators can be found on page 9 of the 2018 MPI Methodology paper (See: Alkire et al 2018).

Indicator	Mann-Whitney U test p-value	Mann-Whitney effect size
Vulnerable to poverty	0.0000000137	0.631
Electricity	0.0000000164	0.625
School attendance	0.0000000271	0.617
Assets	0.000000471	0.556
Years of schooling	0.000000764	0.546
Drinking water	0.00000144	0.531
Cooking fuel	0.00000151	0.53
In severe poverty	0.0000393	0.448
Sanitation	0.0000422	0.446
Inequality among the poor	0.0000383	0.442
Flooring	0.062996	0.174
Child mortality	0.392674	0.031
Nutrition	0.433758	0.01

Table 7: Associations between MPI indicators and tenure conflicts

Results: The results are summarized in Table 7. Where the p-value is less than 0.05 we can reject the null hypothesis at a 95% confidence level and conclude that the distributions of the variables are different for all variables apart from ‘Flooring’, ‘Child mortality’ and ‘Nutrition’.

Assuming the spread and shape of the distributions between the control and case group are the same, this implies that the medians of the two groups is different. The effect size is a measure of the difference between the two data sets. The indicators have been ordered by the effect size, with ‘Vulnerable to poverty’ showing the largest difference between the control and dispute locations.

Conclusions: These results lend support to those found at the national level, and provide empirical evidence that poverty levels contribute to tenure conflicts at the sub-national level. This relationship with tenure disputes exists in terms of absolute levels of various dimensions of poverty, as well as with relative levels of poverty. These findings suggest that understanding local poverty levels and the particular deprivations people face is critical in mitigating tenure risk over a project that affects those people.

Population Growth

We examined population distribution data from the Gridded Population of the World Dataset (v4), looking at change in population between 2005 and 2015. We also looked at total population levels in the area, using the same dataset.

Hypothesis: We expected that dispute locations would have seen higher population growth over the period in which they occurred, as a result of increased demand for local resources and correspondingly greater pressure on them. We also expected that places where tenure conflict occurred would have higher population densities than non-dispute locations.

The presence of people is a necessary condition for tenure disputes – there are, for all practical purposes, no locations on land where there are no people affected by private investment.³⁶ But little is known about how demographic trends affect the occurrence of tenure disputes.

Analysis: For each indicator, we compared population change and overall population density values in dispute locations against control locations.

Results: As Figure 5 shows, the two groups of locations have significant differences in terms of average population growth. The maximum values – excluding outliers – are similar between the two groups. However, places where tenure disputes occurred uniformly witnessed positive population growth, while a number of places without documented disputes experienced population declines. The mean growth was significantly higher in the dispute locations (at 46.3%), with the large number of non-dispute locations seeing low growth or declines skewing the average downwards (giving a mean growth rate of 25.7%).

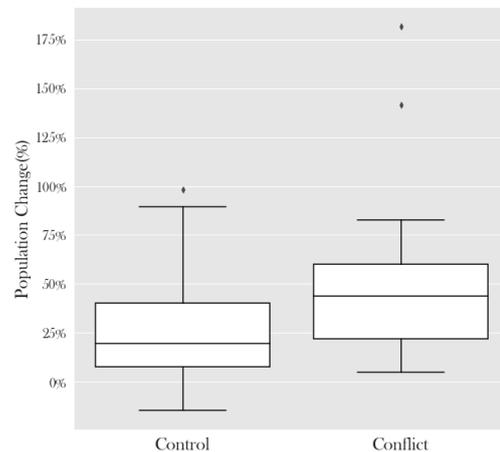


Figure 6: Population change between 2005 and 2015 in control and dispute locations

The results of a binomial logistic regression test demonstrated historic population growth to be a significant predictor for tenure conflict occurrence. Table 8 below shows that the differences between the two groups were well below the significance threshold of 0.05 (at a 95% level).

Indicator	Logistic regression p-value
Population Change (% , 2005-2015)	0.0000000673

Table 8: Significance of the difference in average land use change between control and dispute locations

We did not find a statistically significant association between tenure conflicts and absolute population density values in the analysis of palm oil projects. While there were some tentative associations from the hydropower sector analysis, further analysis is needed to confirm that these associations are robust when taking into account different geographic characteristics between the two sample groups.

Conclusion: Historic population growth can be helpful in identifying areas that may be more prone to tenure risk; projections of future growth may also be of interest in assessing risks for investments reliant on long-term projects. Further research on absolute population levels, and to provide a more temporally specific population growth rate for each conflict location, would help answer some of the questions raised by these findings.

³⁶ The Munden Project (2014), “Communities as Counterparties: Preliminary Review of Concessions and Conflict in Emerging and Frontier Market Concessions.” Available at: https://rightsandresources.org/wp-content/uploads/Communities-as-Counterparties-FINAL_Oct-21.pdf

Governance

Access to power of ethnic groups

We used the geocoded version of the Ethnic Power Relations database to look for relationships between local groups’ access to power and the incidence of tenure disputes. The dataset identifies all ‘politically relevant’ ethnic groups and their access to state power, from 1946-2017. It provides seven classifications of this access, which we placed into three categories: access to power (where their status is ‘Junior Partner’, ‘Dominant’, ‘Senior partner’ or ‘Monopoly’) no access to power (‘Powerless’ or ‘Discriminated’), and self-excluded (‘Self-exclusion’).

Hypothesis: Our hypothesis was that tenure dispute locations would have more ethnic groups without access to power relative to the number of groups with access to power.

This is because marginalized minority groups like indigenous peoples are involved in over half of tenure disputes in our Tenure Conflict Database.

Analysis: We analyzed the number of ethnic groups with access to power, the number of groups without access to power, and the ratio between the two numbers. We then compared these values between control and dispute locations.

Results: We found that places that had seen tenure disputes were, on average, home to more than twice as many groups that had no access to power than the control locations – i.e. dispute locations were much more likely to have higher numbers of marginalized groups living in them. Conversely, dispute locations were very rarely populated by groups with access to power, but control locations typically had at least two of these groups in the area.

In short, the proportion of ethnic groups in the area that had access to central state power, compared to excluded groups, had a statistically significant relationship with tenure conflicts. Our analysis, using a Mann-Whitney U test, suggested that this was a strong relationship (Cliff’s delta = 0.855). Table 9, below, shows the results for these tests.

Indicator	Mann-Whitney U test p-value
Access to Power (proportion of local groups)	0.0000000000000000689

Table 9: Associations between Access to Power of local ethnic groups and tenure conflicts

Conclusions: These results suggest that politically excluded groups are more prone to being involved in tenure disputes. This result would benefit from further investigation, both qualitative – to explore how these results align with a more in-depth review of the dynamics of particular cases particular – and quantitative, to assess whether changes in group status over time have an effect.

5. Results: national indicators

We found correlations between the incidence of tenure conflict per \$FDI and each of the national governance and poverty indicators we looked at. The strongest of these associations were with Human Development Index scores and Government Effectiveness, while the weakest were with Political Stability.

Governance

We focused on seven indicators drawn from two datasets: the six indicators of the Worldwide Governance Indicator dataset produced by the World Bank, and the Corruption Perceptions Index from Transparency International.

For each indicator of governance, we expected inferior governance scores to be associated with higher rates of tenure dispute per \$FDI. Our results confirmed this hypothesis: each of these indicators had a statistically significant relationship with the incidence of tenure risk. The strengths of this association, however, was not uniform across all indicators.

Figures 6 and 7 below show the strength of the association for each indicator with cases per \$FDI and the natural log of the cases per \$FDI, respectively. These charts show Spearman's and Pearson's correlation coefficient figures, for which values closer to -1 indicate a stronger relationship, while 0 indicates no relationship.

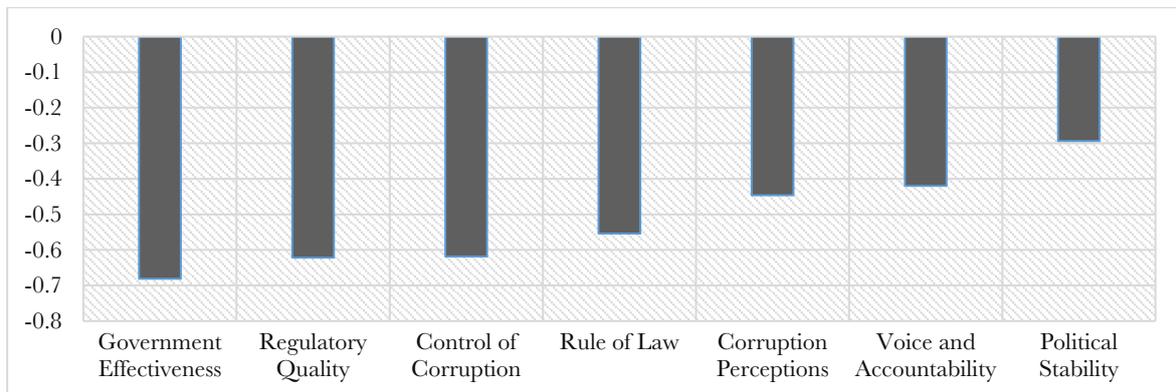


Figure 7: Spearman's correlation coefficients for associations between governance indicators and cases per \$FDI

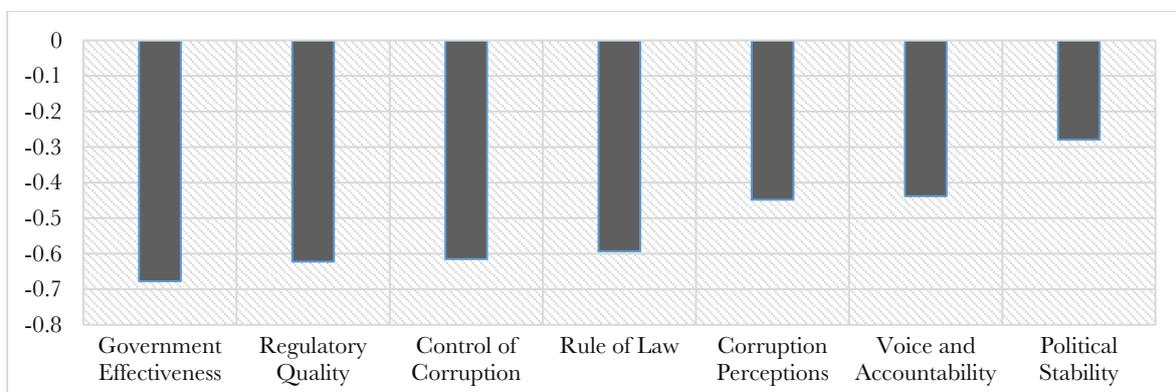


Figure 8: Pearson's correlation coefficients for associations between governance indicators and log of cases per \$FDI

Corruption

The WGI ‘Control of Corruption’ indicator measures perceptions of “the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as ‘capture’ of the state by elites and private interests.”³⁷ It is measured on a scale from -2.5 (worse scores) to 2.5 (better scores).

Transparency International’s Corruption Perceptions Index scores countries “by their perceived levels of public sector corruption according to experts and businesspeople,” using a scale from 0 (highly corrupt) to 100 (very clean).

Hypothesis: We expected to see higher incidence of tenure conflicts in places with worse perceptions of corruption. This is because our qualitative research has frequently identified cases in which corruption has played a major role in driving disputes, for example when officials grant permits improperly. Evidence from De Schutter, the International Corporate Accountability Roundtable, and Global Witness indicate that these are not isolated incidents.³⁸

Analysis: We used the log of cases per \$FDI to in each country to compare with relevant average Control of Corruption and Corruption Perceptions Index scores. We then analyzed Pearson’s correlation coefficients of the relationship. We use Cohen’s standard to classify the strength of that relationship.

Results: Our analysis provides quantitative evidence that corruption has a role in generating tenure disputes: as perceived corruption increases, so do incidents of tenure dispute per \$FDI. For Control of Corruption, we found a strong, statistically significant relationship with tenure conflicts (Spearman’s correlation coefficient = -0.6184), and with the log of tenure conflicts (Pearson’s coefficient = -0.6152), per dollar of FDI in a given country.

Transparency International’s Corruption Perceptions Index also showed a statistically significant relationship with tenure conflicts (Spearman’s correlation coefficient -0.4464), and with the log of tenure conflicts (Pearson’s correlation coefficient = -0.4482) per dollar of FDI in a given country.

Indicator	Pearson’s coefficient	Pearson’s p-value	Cohen’s Standard
Control of Corruption	-0.6152	0.0000000186	Strong association
Corruption Perceptions Index	-0.44816	0.008908421	Moderate association

Table 10. Associations between corruption indicator scores and the log of tenure conflicts per \$FDI

Conclusion: These results provide quantitative evidence in support of the theory that corruption plays a role in driving tenure disputes. Further statistical analysis on how

37 Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi (2010), “The Worldwide Governance Indicators: Methodology and Analytical Issues.” Policy Research Working Paper 5430. The World Bank, Development Research Group, Macroeconomics and Growth Team. Available at: <https://papers.ssrn.com/abstract=1682130>

38 De Schutter, Olivier (2016), “Tainted Lands: Corruption in Large-Scale Land Deals.” International Corporate Accountability Roundtable and Global Witness. Available at: <https://www.globalwitness.org/en/campaigns/land-deals/tainted-lands-corruption-large-scale-land-deals/corruption-large-scale-land-deals/>.

corruption interacts with other factors would help explore under what other conditions corruption plays a greater or lesser role in driving these kinds of disputes.

Government effectiveness

The WGI Government Effectiveness indicator is defined as “perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.”³⁹ It is measured on a scale from -2.5 (worse scores) to 2.5 (better scores).

Hypothesis: Our hypothesis was that places with weaker Government Effectiveness scores would be witness to greater levels of tenure dispute per \$FDI.

This is because research shows that companies working in places with weak regulatory enforcement often get caught out later when national governments, often under significant pressure from civil society, choose to enforce regulations locally.⁴⁰

The capacity of national and local civil servants is particularly important in enabling projects to move forward as planned – delays and changes can damage trust between counterparties. Capacity is also critical in codifying and resolving the myriad land claims and disputes that are typical of emerging markets, and which frequently contribute to tenure conflicts. The complexities are increasingly understood by national governments but many local administrations remain unable to provide adequate accurate guidance and support.

Analysis: We used the log of cases per \$FDI to in each country to compare with relevant average Government Effectiveness. We then analyzed Pearson’s correlation coefficients of the relationship. We use Cohen’s standard to classify the strength of that relationship.

Results: We found that countries with worse scores for Government Effectiveness did indeed see higher levels of tenure conflicts, and that the association with tenure conflicts per \$FDI was strong. The analysis showed a strong correlation between Government Effectiveness and the incidence of tenure conflicts (Spearman’s correlation coefficient = -0.6812) and with the log of tenure conflicts (Pearson’s correlation coefficient = -0.6774) per dollar of FDI (see Table 11 below).

Indicator	Pearson’s coefficient	Pearson’s p-value	Cohen’s Standard
Government Effectiveness	-0.6774	0.000000000164	Strong association

Table 11: Associations between Government Effectiveness scores and the log of tenure conflicts per \$FDI

Conclusion: These results suggest that investors and operators of assets in emerging markets should pay particular attention to the ability of governments to effectively administer their

³⁹ Ibid.

⁴⁰ For example, EcoEnergy’s project in Bagamoyo, Tanzania was eventually cancelled after some of the land was designated as a protected area. But the land had been suggested and allocated by the government, which was initially highly supportive of the project. It seems that this support was removed following a series of tenure disputes and civil society campaigns.

policies and regulations, and the quality of the civil service. Failure to do so may expose real assets in these markets to disruptions as a result of tenure disputes.

Political stability and absence of violence

The Political Stability metric measures “perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism”. It is graded on a scale from -2.5 (worse scores) to 2.5 (better scores).

Hypothesis: We tested the hypothesis that worse scores for Political Stability and Absence of Violence would correlate with higher rates of tenure conflict per \$FDI in a country.

We would anticipate a strong correlation between the political stability and tenure disputes, as political instability could allow elites with both opportunity and cover to further their own interests at the expense of disempowered communities and unwitting investors.

Analysis: We used the log of cases per \$FDI to in each country to compare with relevant average Political Stability and Absence of Violence scores. We then analyzed Pearson’s correlation coefficients of the relationship. We use Cohen’s standard to classify the strength of that relationship.

Results: Our analysis suggests that while worse political stability is, overall, associated with higher levels of tenure conflict, there are a number of places – especially with middling scores for this indicator – that do not follow this trend. We found a weak linear association between the two variables (Spearman’s correlation coefficient = -0.2936), and with the log of cases per \$FDI (Pearson’s correlation coefficient = -0.2795 – see Table 12 below).

Indicator	Pearson’s coefficient	Pearson’s p-value	Cohen’s Standard
Political Stability	-0.27952	0.02001864	Small association

Table 12: Associations between Political Stability scores and the log of tenure conflicts per \$FDI

Conclusion: These results show an association between scores for Political Stability and Absence of Violence and the incidence of tenure conflicts, albeit the correlation is relatively weak. Additional research on interactions between this indicator and others may reveal conditions in which it plays a greater role in the development of tenure disputes.

Regulatory quality

WGI’s Regulatory Quality indicator measures “perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.”⁴¹ It is measured on a scale from -2.5 (worse scores) to 2.5 (better scores).

Hypothesis: We expected that places with lower scores for regulatory quality would experience greater numbers of tenure conflicts per \$FDI.

The quality of regulation in a country has strong intuitive connections with tenure disputes. Where regulations and policies do not adequately cover issues around private investment in

⁴¹ Kaufmann et al (2010)

land, there exists a significant space for deal makers to ignore local peoples’ usage of and rights to natural resources.

Analysis: We used the log of cases per \$FDI to in each country to compare with relevant average Regulatory Quality scores. We then analyzed Pearson’s correlation coefficients of the relationship. We use Cohen’s standard to classify the strength of that relationship.

Results: We found that as regulatory quality decreases, the number of tenure conflicts per \$FDI did increase as anticipated. The analysis showed a strong, statistically significant negative linear relationship between Regulatory Quality and tenure conflicts (Spearman’s correlation coefficient = -0.6220), and with the log of tenure conflicts (Pearson’s correlation coefficient = -0.6224), per dollar of FDI in a given country (see Table 13 below).

Indicator	Pearson’s coefficient	Pearson’s p-value	Cohen’s Standard
Regulatory Quality	-0.6224	0.0000000113	Strong association

Table 13: Associations between Regulatory Quality scores and the log of tenure conflicts per \$FDI

Conclusion: These results provide evidence that the regulatory quality of a country should be a key factor that investors and operators consider in assessing tenure risk. Further work on the interaction between this indicator and other indicators would be insightful in understanding how different factors affect regulatory quality’s contributions to the occurrence of tenure conflict.

Rule of Law

The WGI Regulatory Quality indicator describes perceptions of how much confidence and respect people have in the rules set out by society, focusing on “quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.”⁴² It grades on a scale from -2.5 (worse scores) to 2.5 (better scores).

Hypothesis: Our hypothesis for this indicator was that countries with worse regulatory quality would see higher rates of tenure conflict per \$FDI.

This is because the rule of law, including the ability to enforce contracts and for laws to be upheld across the country, has a number of theoretical connections with tenure disputes. Strong property rights could be seen as important to protecting the rights of people threatened with dispossession of their land, for example. We also know from our previous research that tenure disputes often occur as a result of, or are exacerbated by, issues with contract enforcement (in relation to compensation agreements, for example).

Analysis: We used the log of cases per \$FDI to in each country to compare with relevant average Rule of Law scores. We then analyzed Pearson’s correlation coefficients of the relationship. We use Cohen’s standard to classify the strength of that relationship.

Results: We found a statistically significant association between the rule of law and tenure conflicts in a given country. The analysis showed a moderate association (Spearman’s correlation coefficient = -0.5540) between the Rule of Law score and the number of tenure

⁴² Ibid

conflicts per \$ FDI, and a strong association with the log of this metric (Pearson’s correlation coefficient = -0.5934, see Table 14 below).

Indicator	Pearson’s coefficient	Pearson’s p-value	Cohen’s Standard
Rule of Law	-0.59339	0.0000000773	Strong association

Table 14: Associations between Rule of Law scores and the log of tenure conflicts per \$FDI

Conclusion: These results support the theory that weak rule of law contributes to tenure disputes. Further research into particular cases would help shed light on the circumstances in which rule of law plays a greater or lesser role in contributing to tenure disputes.

Voice and accountability

The WGI Voice and Accountability indicator assesses perceptions of “the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media”⁴³ at the national level. It is measured on a scale from -2.5 (worse scores) to 2.5 (better scores).

Hypothesis: Worse scores for Voice and Accountability would be associated with greater levels of tenure conflict.

Low accountability of government allows government officials to bypass local claims to land and resources. Limits on freedom of association and the media can prevent affected groups from asserting their claims to local resources in negotiations, fostering unresolved grievances and direct action. On the other hand, we might expect repressive regimes and poor media freedom to stifle dissent and thus lessen the incidence (and reporting) of major disputes.

Analysis: We used the log of cases per \$FDI to in each country to compare with relevant average Voice and Accountability scores. We then analyzed Pearson’s correlation coefficients of the relationship. We use Cohen’s standard to classify the strength of that relationship.

Results: We found that as citizens’ freedom of expression and dissent, and governmental accountability increase, the rate of tenure conflict per \$FDI decreases. Our statistical analysis showed a small linear association with the incidence of tenure conflict (Spearman’s correlation coefficient = -0.4196), and with the log of tenure conflicts (Pearson’s correlation coefficient = -0.4385), per \$FDI in a given country (see Table 15, below).

Indicator	Pearson’s coefficient	Pearson’s p-value	Cohen’s Standard
Voice and Accountability	-0.43848	0.000164264	Strong association

Table 15: Associations between Voice and Accountability scores and the log of tenure conflicts per \$FDI

Conclusion: These results suggest that limits on freedom of expression and association and democracy may contribute to the occurrence of disputes over tenure issues. However, because most places with poor Voice and Accountability scores also score poorly in other governance indicators, further work would help in understanding this covariance, and how best to combine the indicators to comprehend their associations with tenure issues specifically.

⁴³ Kaufmann et al (2010)

Poverty

Human Development Index

We used the Human Development Index to analyze the relationship between national levels of poverty and the occurrence of tenure conflicts. HDI score values range from 0-1, where:

- Values 0-0.55 indicate low human development (typical for Sub-Saharan Africa)
- Values 0.8-1 indicate very high human development (typical for OECD countries)

Hypothesis: Following studies suggesting links between poverty and tenure disputes, we expected lower HDI values to correlate with higher incidences of tenure conflict.⁴⁴

Analysis: We compared the log of cases per \$FDI to in each country to relevant average Human Development Index scores. We then analyzed Pearson’s correlation coefficients of the relationship. We use Cohen’s standard to classify the strength of that relationship.

Results: A strong linear relationship between the national HDI value and the number of tenure disputes that occur per average \$FDI. The higher a country’s level of human development, the fewer tenure disputes it sees as a proportion to the amount of investment.

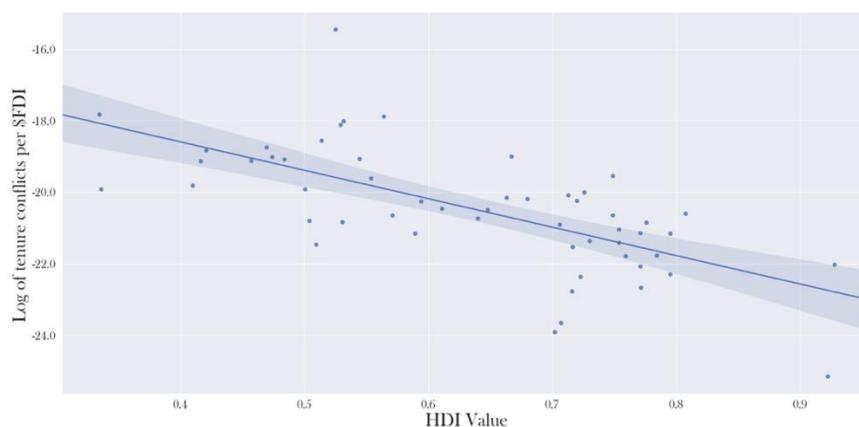


Figure 9: HDI score values against the number of tenure conflicts per \$FDI

Table 16 provides the results of the Pearson’s tests.

Indicator	Pearson’s correlation coefficient	Cohen’s Standard
HDI score	-0.669	Strong association

Table 16. Association between HDI score and the natural log of tenure conflict cases per \$FDI

Conclusion/further work: These results add quantitative evidence in support of the theory that higher levels of poverty – as measured by a broad index that captures health, education, and income dimensions – contribute to the occurrence of tenure conflicts. The results of our testing of the Multidimensional Poverty Index (see pages 23-25 below) offer some interesting insights into the particular dimensions that may play the biggest role.

⁴⁴ See, for example, Kircherr et al (2016).

6. Conclusion

These findings directly inform the way that Landscape rates locations, based on the ESG context of the local area selected by the user. But there are also broader implications for Landscape from a system design point of view.

First, the fact that we have found relationships with the indicators described in this document suggest that there are likely to be a large number of further ESG datasets (both existing and yet to be published) that will associate with tenure risk. The system has therefore been built with the potential to include those additional datasets over time, and increase its accuracy.

Second, given the linkage between tenure risk and other ESG risks (such as armed conflict, political upheaval, or human rights abuses), there is potential for the system to be used in the assessment of those risks. This means that designing the system with scope to expand its analyses to those other risks offers significant benefit to its users.

In a more direct sense, the models that Landscape uses to provide its various ratings and guidance rely heavily on the relationships described in this document. The methodology document (available [here](#)), describes in more detail how those indicators that showed consistent associations with tenure conflicts are used by Landscape.

For national-level indicators, we ran tested collinearity and performance of multiple indicators in a regression model to determine the most appropriate combination to use in the ratings models used by Landscape. For the sub-national results, statistically significant associations were first confirmed in testing indicators in conflict and control locations for the hydropower sector.⁴⁵ Those indicators for which the relationship was confirmed were then assessed on the basis of the strength of association they showed with tenure conflicts.

As with any nascent field of study, there is of course great potential for further studies to add to and improve upon the ones presented above. Additional and improved datasets on tenure conflicts, on comparable projects that can serve as control groups, and on ESG conditions, are continually improving, offering significant scope for similar and expanded analyses.

As the private sector increasingly engages with development goals there will be a growing need for evidence on how best to manage interactions with the people, places and institutions in which they operate. The evidence provided in this paper provides a foundation for understanding not only the ESG risks of specific locations in emerging markets, but also for further exploration of the opportunities for the private sector to contribute to improving the ESG context in which they operate, creating a virtuous circle of sustainable business practice.

⁴⁵ The hydropower sector offers a useful geographic contrast to palm oil locations, providing a good 'sense-check' that associations are likely to hold true across a range of sectors and geographies. The two sectors also represent a diverse range of tenure disputes in terms of the factors that drove the disputes.