The Geospatial Revolution in Impact Evaluation

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Introduction

We introduce a new impact evaluation tool for spatially-distributed development interventions and discuss its advantages and limitations in conflict and fragile state settings. When geocoded program data are merged with spatially-referenced survey, census, and satellite data on outcomes like poverty, disease, conflict, governance, and environmental degradation, evaluators can employ quasi-experimental methods of causal identification that control for potential confounds and omitted variables at fine geographic levels, thereby potentially addressing the longstanding critiques of evaluations that do not employ randomization methods. These geospatial impact evaluation (GIE) methods create new opportunities to rigorously measure programmatic impact at a substantially lower time and financial cost. Whereas randomized controlled trials often require expensive primary data collection over customized samples and extensive coordination and collaboration between evaluators and implementers over the entire course of a development program, GIEs can be conducted retrospectively and remotely with more easily accessible program, outcome, and covariate data. These features make GIEs particularly useful to evaluators working in conflict and fragile state settings.

Availability of Geocoded Data

Over the last several years, the international development community has witnessed an explosion in the availability of sub-nationally georeferenced programmatic intervention and outcome data. The World Bank was a first mover in publishing spatial program data, launching an ambitious effort in 2010 to geocode the universe of active IDA and IBRD projects. The World Bank now publishes precise latitude and longitude coordinates of all investment projects, and a growing number of bilateral and multilateral aid agencies have followed suit.

A similar pattern of diffusion has been observed in the developing world. Malawi's Ministry of Finance was the first owner and operator of a country-level aid information management system (AIMS) to embrace subnational geocoding of development projects (Weaver et al. 2014). There are now more

than two dozen finance and planning ministries in Africa, Asia, and Africa with subnationally geocoded AIMS data, including Somalia, Colombia, Iraq, Honduras, Nigeria and Afghanistan.[1]

At the same time, subnational data on intended and unintended outcomes have rapidly expanded in number, scope, and accessibility. Census and household survey data, including the Demographic and Health Survey (DHS) and Afrobarometer, are increasingly georeferenced to the level of enumeration areas (Nunn and Wantchekon 2011). Satellite data on luminosity, a proxy for economic development, is now available at high-level spatial resolution and fine time scales (Bundervoet et al. 2015). Data on land cover, population density, climate, distance to roads and cities, and other physical attributes are also widely available.

For evaluations that seek to determine whether a given intervention or bundle of interventions affect conflict outcomes, several sources of sub-nationally geocoded data also exist. The Uppsala Conflict Data Program's Georeferenced Events Dataset (UCDP GED) documents organized violence as far back as 1975 and the Armed Conflict Location and Event Database (ACLED) catalogs political violence and protest in developing countries since 1997. The Integrated Crisis Early Warning System (ICEWS) and the Social Conflict Analysis Database (SCAD) are also rich sources of geocoded, time-varying conflict data.

Geospatial Impact Evaluation

In order to illustrate how these spatial program, outcome, and covariate data open up new avenues for evaluation in conflict and fragile state settings, consider an evaluation that is currently underway on the intended economic effects and unintended conflict effects of natural resource concessions in Liberia. This GIE, which is being led by researchers from AidData, the University of Texas at Dallas, and the Concessions Working Group in Monrovia, aims to identify the effects of different types of foreign direct investment (FDI). For the intervention data, the evaluators drew upon existing, but fragmented data source to assemble a georeferenced dataset of all available concession contracts the Liberian government has awarded to investors since the end of the civil war. The evaluators are merging these data with spatiotemporal outcome and covariate data on poverty, electrification, deforestation, social conflict, and violence from satellites, ICEWS, and multiple DHS waves. Recognizing that FDI projects are not randomly located across Liberia, the evaluators will use propensity score matching methods to compare conflict and economic development outcomes in areas with and without certain types of investment projects. By controlling for potential confounds and omitted variables at fine geographical levels that otherwise might explain changes in the outcomes of interest, this evaluation design will strengthen the counterfactual and improve estimates of programmatic impact. Another important methodological component of this work will be to ensure that the spatial characteristics of the data are appropriately accounted for, such that spatial autocorrelation and spillover effects do not bias the results.

GIE methods can be particularly useful to evaluators working in active conflict and fragile state settings, where outcome data are often scarce and data collection capabilities are limited. When evaluators rely on satellite-base outcome data, the challenges of geographical access and repeated data collection can be easily overcome. Survey, census, and administrative data can also be collected by national statistical offices and line ministries and used in GIEs for multiple donors and programs, thus replacing donor-

[1] AidData has subnationally geo-referenced nearly 140,000 development project locations worth approximately $870 billion in aid. These data can be accessed at http://aiddata.org/subnational-geospatial-research-datasets..

specific and program-specific data collection efforts. By way of illustration, consider a recent evaluation of UN Peacebuilding Fund (PBF) activities in Burundi and how they have impacted social cohesion within communities that have hosted a wave of returning ex-combatants and internally displaced persons (Campbell et al. 2014). In this case, a statistical algorithm was used to match similar locations with and without PBF activities using data collected at various spatial scales. Many of the spatial covariate data – at the colline, commune, and provincial levels – had already been collected by Burundi's national statistical office (ISTEEBU) and various line ministries

Strengths and Limitations

GIE is a useful but underutilized tool for evaluating development interventions that are geographically distributed. It can produce rigorous estimates of programmatic impact in a timely and cost-effective manner. Such evaluations can also be undertaken after project completion and with existing data. For programs with well-documented intervention locations, a desk-based evaluation can often be completed in six months. The potential for replication in various settings also offers significant external validity benefits, and with time-series outcome data evaluators can sometimes look at treatment effects 5 or 10 years after project completion (e.g. BenYishay et al. 2016).

At the same time, evaluators who wish to use GIE methods face a unique set of challenges in settings of active conflict or fragility. The existence of geocoded program data may be limited in areas with highly sensitive programs or high risks of data misplacement. Some organizations opt not to collect detailed locational information about their programs in conflict settings, while others place strict limitations on the use of such data. Additionally, when GIE and qualitative methods are used in conjunction, they can shed light on both causal impacts *and* mechanisms (Campbell et al. 2014); however, evaluators are often not able to visit treatment and control sites and communities in active conflict situations. GIE is only one tool in an evaluator's toolbox, but one that can be used to positive effect in the right circumstances.

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