DISTRIBUTIONAL IMPLICATIONS OF INTERNATIONAL CLEAN ENERGY INVESTMENT: EVIDENCE FROM CDM INVESTMENT INTO BRAZIL

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Overview

Since 2004, the Clean Development Mechanism (CDM) of the Kyoto Protocol has facilitated more than US$ 550 billion of new investment into low and middle income countries, much of which is supporting clean energy infrastructure and related energy projects. An explicit objective of the CDM is to promote 'sustainable development'. Most definitions of sustainable development describe development that prioritizes equality of opportunity in the development process and/or equity in the distribution of the benefits of development. There is growing concern that these equity objectives are being over-ridden by economic efficiency concerns.

This paper examines distributional issues connected to CDM investment flows using new project- and municipality-level data for Brazil. It examines the distribution of CDM investment, projects, and GHG emission reductions across municipality quintiles in terms of municipality economic prosperity and income inequality. The analysis also explores which characteristics of CDM investment projects associate with localisation in relatively poor municipalities and in relatively unequal municipalities. At least in Brazil, CDM investment is flowing disproportionately to more prosperous municipalities and, to a lesser extent, to more unequal municipalities. CDM projects can create significant employment effects (Sutter and Parreño, 2006), particularly for certain types of projects widespread among CDM projects in Brazil, like biomass energy projects. The equitable distribution of projects is an issue that needs to be addressed better by the national authorities responsible for approvals of the siting of projects. Ongoing and future climate pact negotiations should give greater attention to intra-country distribution issues with CDM and other similar clean energy investment insofar as it is envisioned to play a role in sustainable development.

Methods

The data for all CDM projects in Brazil were obtained from the database of the United Nations Framework Convention on Climate Change (UNFCCC). The original dataset includes 342 registered projects occurring between 2004 and 2016. The investment value, annual GHG reductions, project type, and credits issued is observed for each project. The project design document (PDD) for each project also contains information about the municipality that the project activities occur in, but this information was not machine-readable. The PDD for every project was manually examined and the geographic location of project activities by municipality was recorded.

Knowing the municipality or municipalities that the project was located in made it possible to match the project data to economic data for Brazilian municipalities. GDP per capita data by municipality were obtained from the Brazilian Institute of Geography and Statistics (IBGE). Gini index data by municipality were obtained from the United Nations Development Project's Atlas of Human Development in Brazil (2013).

The data were analysed by looking at the distribution of projects and investments in terms of economic strength (GDP per capita) as well as income inequality (Gini index) of the municipalities. All the 5570 municipalities of Brazil were classified into quintiles according to their GDP per capita in 2014, with the first quintile being the economically weakest and the fifth being the economically strongest. Similarly, they were also classified into quintiles according to the income inequality in the municipality, the first quintile being the most equal and the fifth quantile the least equal in terms of income inequality. The amount of investment and number of projects in each quintile were compared to each other, with the null hypothesis being that they are equally distributed.

A logistic regression model was used to explore which characteristics of CDM investment projects associate with project localization in relatively poor municipalities, and which project characteristics associate with localization in relatively unequal municipalities. The outcome variable took a value of 1 if the municipality the project was localized in was below the median in terms of GDP per capita (or in terms of income distribution). This binary variable was regressed on project characteristics, including project type (biomass energy, hydro, methane avoidance, wind power, and landfill gas), investment value, and the geographic fractionalization or 'spread' of the project across municipalities.

Results

Approximately 39 percent of CDM projects in Brazil to date involve activities that spread across multiple municipalities. Of the 5,570 municipalities in Brazil, 530 host at least part of a project. The distribution of CDM investment across municipalities is slightly more unequal than the distribution of GDP across municipalities. This finding is sensitive to the inclusion of a few large, multi-billion dollar CDM investment projects (hydroelectric power generation).

The quintiles analysis finds that that CDM projects and investments generally tend to flow into municipalities that are in the higher quintiles of economic development, in terms of GDP per capita. A similar pattern is present across quintiles based on the Gini index of each municipality, This points to CDM investment flowing disproportionately more to more prosperous municipalities and, to a lesser extent, to more unequal municipalities.

The logit regression analysis finds that CDM projects involving wind power are significantly more likely to localize in relatively poor municipalities. Projects involving a large amount of fractionalization or 'spread' across municipalities (such as methane avoidance projects involving altering animal feedstock) associate with localization in relatively poor muniticipalities. Projects involving larger investment volumes are less likely to localize in relatively poor municipalities.

When the binary dependent variable takes a 1 for unequal municipalities, measured by a Gini coefficient above the median, the results are as follows. Projects involving wind power and high investment levels are less likely to locate in unequal municipalities. Projects involving a large amount of geographic fractionalization are more likely to locate in unequal municipalities.

Conclusions

An abundance of literature shows that 'ordinary' foreign direct investment (FDI) tends to concentrate in relatively prosperous regions within countries and so benefit more prosperous socioeconomic groups disproportionately. This research investigates whether international clean energy and related investment flows carry the same distributional implications for welfare and development as 'ordinary' FDI.

This is the first research to the knowledge of the authors to examine the intra-country distribution of CDM investment at municipality level and across social groups defined by economic prosperity and economic inequality; like in Röttgers and Grote (2014), till date the literature has focused largely on inter-country comparisons or inter-province comparisons. Building upon Funkhauser and Burton (2011), it is argued that if CDM investment is at least as unequally distributed as ordinary FDI, this raises questions of equity for national authorities who have considerable leverage in the evaluation of project proposals. Just as the localisation of CDM investments and the socioeconomic groups they benefit is a matter for national governments in host countries, it is also an issue for international administration of the CDM program itself.

As per the Kyoto Protocol that established the CDM, one of the objectives of the project is to promote sustainable development in the host countries (non-Annex I) of the projects. This research finds that CDM investment displays distinct patterns in terms of the geographic distribution of its economic benefit. A policy implication of this research is for CDM managers nationally and internationally to consider policy options for promoting greater equity in the distribution of CDM investment benefits, in keeping with the true and received meaning of sustainable development. One such option could involve a financial penalty that discourages projects from locating in regions where they would exacerbate national or sub-national inequality, on the grounds that the greater inequality caused by the mal-distribution of international investment eventually falls to the state to ameliorate.

References

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