

LOCAL EMPLOYMENT CREATION THROUGH CLEAN ELECTRICITY GENERATION--AN ANALYSIS FOR BRAZIL AND A STAGGERED DIFFERENCE-IN-DIFFERENCE APPROACH

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Overview

The article titled "Local employment creation through clean electricity generation--an analysis for Brazil and a staggered difference-in-difference approach" evaluates the investments made by the Brazilian Development Bank (BNDES) and their contribution to economic production, job creation, and changes in average wage levels at the municipal level in Brazil between 2003 and 2017. Similar to the work of Grover and Rao (2020), the investments are separated by type, in this case, divided into investments outside of electricity production, electricity production, and clean electricity production. Using panel data compiled from BNDES, IBGE, and the Annual Survey of Employment (RAIS), a two-way fixed effects econometric model (TWFE) is employed to test the hypothesis that BNDES investments have an effect on the outcome variables of interest. Such analysis is relevant for a development bank such as BNDES to study the priorities that sustainable development implies for the bank in environmental, social, or economic matters.

Methods

Empirically, we consider the case of Brazil, where its national development bank (Banco Nacional de Desenvolvimento Econômico e Social, BNDES) played an important role in stimulating infrastructure development projects in the absence of private capital investments (Hanley et al. 2016). In this article, we link the Bank's activities from 2003 to 2017 to the sustainable development agenda, examining its investments in electricity production (clean and fossil) and their impacts on per capita GDP levels, employment levels, and wage levels. The current literature that has addressed the Bank's project impacts on job creation has focused on its overall impact without distinguishing project types (Pereira 2007, Reiff et al. 2007, Torres Filho and Puga 2006) or addressed impacts on productivity (Coelho 2011). Another literature has also focused on impacts on investment (Barboza and Vasconcelos 2019). However, since electricity production projects represented nearly 20% of all BNDES investments over the 2003-2017 period (amounting to approximately 91 billion Reais or 37.6 billion USD, the impact of these projects on economic outcomes deserves our attention.

From a theoretical standpoint, the article follows a current in the policy evaluation literature that focuses on the socioeconomic impacts of development investments, particularly clean energy investments. The literature attests to the fact that clean energy investments require different labor and skill needs than investments in other projects, including fossil energy projects. Therefore, it is hypothesized that these different investments could also have different socioeconomic outcomes.

To test these differences empirically, the data was organized in a panel structure, with a "staggered" structure, which implies that the treatments (i.e. influx of investments in a municipality) occurred at different times in the panel. Recent advances in econometric literature have allowed for the consideration of staggered treatments while using TWFE models (Goodman-Bacon 2018, Callaway and Sant'Anna 2021), which were applied in the econometrics presented in this chapter. In addition, an inverse probability weighting (IPW) approach as well as the inclusion of fixed effects (doubly-robust estimator) were used in the model to account for endogeneity problems and to highlight causal effects. Dynamic treatment effects were also presented to analyze the persistence of the effects of these investments.

Results

The results indicate that while BNDES development investments had generally positive effects on economic production, employment, and average wage levels in Brazilian municipalities, they also indicate that the magnitude of the effects is different for investments in electricity production (mainly investments in clean electricity production) and other development investments, with electricity production investments being less effective than other development investments. Differences can also be noted between electricity production in general and clean electricity production in particular.

Conclusions

However, these differences must be analyzed in the context of the positive externalities that clean electricity investments bring, which are not internalized in the national accounting data used in this chapter. The results from this article aim to provide guidance to BNDES and other development banks to adopt a broader, multidimensional and socio-economic factors-based vision of sustainable development, in addition to environmental factors.

References

- Barboza, R. d. M. & Vasconcelos, G. F. (2019), 'Measuring the aggregate effects of the Brazilian Development Bank on investment', *North American Journal of Economics and Finance* **47**(May 2018), 223–236. **URL:** <https://doi.org/10.1016/j.najef.2018.12.013>
- Callaway, B. & Sant'Anna, P. H. (2021), 'Difference-in-Differences with multiple time periods', *Journal of Econometrics* **225**(2), 200–230. Coelho, D. & de Negri, J. A. (2011), Impacto do financiamento do BNDES sobre a produtividade das empresas : uma aplicação do efeito quantílico de tratamento, in 'Anais do XXXVIII Encontro Nacional de Economia'.
- Goodman-Bacon, A. (2018), 'Difference-in-Differences With Variation in Treatment Timing', *NBER Working Paper Series* (25018). **URL:** https://www.nber.org/system/files/working_papers/w25018/w25018.pdf, accessed on 29 June 2021
- Grover, D. & Rao, S. (2020), 'Inequality, unemployment, and poverty impacts of mitigation investment : evidence from the CDM in Brazil and implications for a post-2020 mechanism', *Climate Policy* **20**(5), 609–625. **URL:** <https://doi.org/10.1080/14693062.2020.1760773>
- Hanley, A. G., Pires, J. M., de Souza, M. J. P., Marcondes, R. L., de Faria, R. N. & Sakurai, S. N. (2016), 'Critiquing the bank : 60 Years of BNDES in the academy', *Journal of Latin American Studies* **48**(4), 823–850. 2
- Pereira, R. D. O. (2007), 'Ação do BNDES sobre o Emprego Formal : Efeito nas Empresas Financiadas', *Revista do BNDES* **14**(27), 27–42.
- Reiff, L. O. d. A., dos Santos, G. A. d. A. & Rocha, L. H. R. (2007), 'Emprego Formal, qualidade de vida e o papel do BNDES', *Revista do BNDES* **14**(27), 5–26.
- Torres Filho, T. E. & Puga, F. P. (2006), 'Empresas apoiadas pelo BNDES geram mais emprego e pagam mais', *BNDES Visão do Desenvolvimento* (17).