Data Centers and Local Markets: A Possible Exploration in France?

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As advanced ICT tools – such as AI systems – become increasingly integrated into production, the volume of data flows, analytics, and management expands accordingly. In this context, data centers play a crucial role in shaping national computing and storage capabilities (Lehdonvirta et al., 2024). This has significant implications for a nation's ICT infrastructure in the AI era, particularly as the computational power required to train frontier AI models has been doubling approximately every six months (Heim et al., 2024). Yet, the literature remains largely silent on several key implications. This research proposal explores how data centers may impact energy and labor markets at the local level and proposes an empirical strategy to analyze these effects.

On the one hand, the activity of data centers is not solely linked to electricity consumption from computing activities (Shehabi et al., 2024). It also has direct employment effects, as these facilities operate 24/7 and require staff across multiple shifts. On the other hand, data centers may serve as catalysts for local agglomeration economies by providing essential computing power and storage infrastructure, thereby affecting employment (and its composition) and energy consumption in surrounding areas. This influence may materialize through two primary mechanisms: firm relocation and local digitalization. Due to latency considerations (Papadakis and Savona, 2024), data-intensive firms may find it advantageous to locate near data centers, and existing firms may accelerate their digital transformation, benefiting from improved local ICT capabilities and infrastructure.

Given these different channels, the overall impact of data centers on local energy and labor markets remains ambiguous. The direct effect of data center openings on local energy consumption is uncertain, as the net impact depends on the balance between rising energy demand and potential efficiency gains (Masanet et al., 2020). If demand increases, data centers' electricity consumption may crowd out that of other firms by driving up electricity prices. Additionally, the location choices of high-tech ICT firms could further raise local energy consumption, while improved ICT capabilities might generate energy savings through efficiency spillovers induced by digitalization. Similarly, the opening of data centers and new firms may impact on labour markets by spurring local processes of digitalization. As the digitalization of firms may displace certain jobs while simultaneously creating new tasks (Acemoglu and Restrepo, 2019), not only compositional, but also positive or negative effects on employment may emerge.

To address these questions, we propose estimating the impact of data centers on local employment and energy markets in France. The geographical locations of data centers can be identified from multiple sources (e.g., S&P data), which provide address-level information. These locations can be matched to the French Business Registry to obtain establishment-level fiscal identifiers. These codes can be linked to establishment-level employment data from DADS (2003-2022), to which I have personal access. This dataset also allow to characterize local labour markets by aggregating information on establishments based on their location. Additionally, data centers can be linked to municipality- and address-level energy consumption data (2018-2023).

This rich dataset enables the application of various empirical methodologies. First, a staggered difference-in-differences (Callaway and Sant'Anna, 2021) can be employed to exploit the timing of new data center openings across municipalities. This methodology is particularly well-suited to our data, as it allows for pre-trend testing and the estimation of dynamic effects, which are likely to emerge as digitalization processes unfold (Brynjolfsson et al., 2018). Second, alternative methodologies, such as instrumental variable (IV) estimation, may be explored. Given the cooling requirements of CPUs, two potential IVs could be local temperature and water availability.

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