

Public Capital Efficiency and Regional Growth Dynamics in Morocco:

An Analysis Using a Hybrid Approach Combining Stochastic Frontier and Dynamic Regional CGE Models

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Introduction

Morocco has sustained economic growth over the past few decades, with an average rate of 4.4%, thanks to ambitious reforms and strategic investments in key sectors such as agriculture, industry, and renewable energies. However, this dynamic masks significant regional disparities, which hinder the country's potential for inclusive growth and equitable development. In 2021, according to the regional accounts of the High Commission for Planning (HCP), Casablanca-Settat contributed 32.2% of the national GDP, while other regions like Drâa-Tafilalet and the Southern regions generated only 7.7%. The average gap between regional GDPs has widened further, increasing from 66.4 billion DH in 2020 to 71.8 billion in 2021.

Moroccan state policies have aimed to incorporate regions into the capital accumulation framework to mitigate these disparities, notably through sophisticated regionalization efforts and significant transportation infrastructure developments. These initiatives seek to invigorate economic activity, enhance institutional capabilities, and guarantee broader access to possibilities. Nonetheless, their influence is constrained by local particularities, different investment levels, and deficiencies in governance structures. This underscores a fundamental problem: the inefficient allocation of funds at the regional level.

Capital efficiency, essential for sustainable growth, relies on the optimal use of resources and investments in public capital (infrastructure, education, essential services) to stimulate private capital and innovation (Hansen, 1965). Spatial externalities (Kubo, 1995; Fujita & Thisse, 1995), by integrating markets and disseminating knowledge, help reduce territorial disparities (Jacob, 1969). According to the Commission for the Development Model, decentralized, inclusive, and region-specific policies are necessary to reduce economic disparities in Morocco. This work aims to analyze how investment in public capital and its spatial externalities can strengthen territorial cohesion, stimulate the economy of marginalized regions, and promote balanced growth.

Literature Review

This study explores the relationships between public capital, capital efficiency, and regional growth dynamics. It employs two theoretical frameworks: endogenous growth theory and geographical economics.

In the endogenous growth theory, Romer (1986) and Lucas (1988) emphasize that accumulating human capital, technological innovation, and productive public investments are essential to stimulate growth. Barro (1990), building on the work of Aschauer (1989), shows that public infrastructure improves the efficiency of private capital, reduces production costs, and generates positive externalities. Geographical economics, developed by Krugman (1991) and further explored by Fujita and Thisse (2002), highlights the impact of infrastructure and agglomeration mechanisms on the location of economic activities while emphasizing the risks of wealth concentration.

The stochastic efficiency approach, developed by Aigner, Lovell, and Schmidt (1977), is frequently employed to assess productivity discrepancies among areas. This instrument assesses the disparity between actual output and an ideal frontier to examine technological inefficiency and ascertain its origins.

Research demonstrates its efficacy in regional assessments. Rui Hao (2007) examined economic growth in China from 1978 to 2003, revealing that the accumulation of physical capital predominantly helped established regions, whilst improvements in technical efficiency facilitated the advancement of underdeveloped regions. Battese and Coelli (1995) demonstrated that including explanatory factors facilitates the examination of determinants like governance and infrastructure quality. Greene (2005) asserted that public expenditures, especially in transportation and water infrastructure, diminish technological inefficiency, enhance agricultural output, and elevate incomes, thus mitigating regional inequities.

Methodology

This study used a hybrid methodology, integrating statistical tools, econometric techniques, and simulation models (MEGC) to examine regional inequalities and capital efficiency in Morocco. This methodology seeks to pinpoint the origins of regional disparities, evaluate the effects of public interventions, and provide measures to enhance resource use and foster inclusive growth. The analysis starts with evaluating regional disparities utilizing the Theil index, which quantifies inequalities in income distribution among areas, and the coefficient of variation, which assesses the variability of output or productivity levels. Descriptive studies augment these variables to elucidate trends and geographic differences among Moroccan regions. To enhance the analysis, we have relaxed the conventional hypothesis of growth accounting, which posits that production must invariably reside on the optimal frontier. A theoretical model grounded in production boundaries has been established, enabling a comprehensive breakdown of growth. This triadic decomposition identifies three primary components: technical progress, which reflects the impact of innovations and improvements in production capabilities; efficiency change, which assesses the optimization of resources to approach the production frontier; and physical capital accumulation, which evaluates the effect of infrastructure investments on productivity during the period from 2000 to 2020. We employed the maximum likelihood method to estimate potential production, utilizing the FRONTIER tool created by Coelli. The assessment of potential output underscores the contributions of capital efficiency, accumulated capital, and technological advancement to growth while evaluating their effects on economic convergence. A dynamic computable general equilibrium (CGE) model, PEP-t regionalized, has been constructed to enhance this research and utilize the acquired results using

a regional social accounting matrix. This model replicates the economic interactions among 12 regions and 21 sectors while integrating the dynamic effects of various growth components. This methodology facilitates a deeper comprehension of the impact of public policies and investments on economic convergence and the mitigation of regional disparities over a decade. To assess the effects of public policies on capital efficiency and their contribution to diminishing productive disparities, we executed simulations concerning public investment in infrastructure under two distinct scenarios: a 10% augmentation in total public investment in infrastructure nationally and a 10% increase in regional capital for each region. These scenarios enable us to discern each region's opportunities and distinct characteristics, thus informing targeted and tailored strategies to mitigate inequalities and foster harmonious development.

Preliminary Results

From 2000 to 2020, regional differences in productivity and wealth in Morocco intensified, reaching a zenith in 2019 before a slight decline in 2020. Certain regions have started to narrow the disparities with the national average; however, substantial gaps remain.

The evaluation and analysis of the stochastic frontier model indicate that, from 2000 to 2021, regional growth was characterized by a shift in the contributions of the primary determinants: technological efficiency, technical advancement, and capital accumulation. From 2000 to 2013, capital investment was pivotal, notably impacting areas such as Rabat-Salé-Kénitra. From 2013 to 2021, the influence of technological advancement strengthened, indicating a transition toward development increasingly propelled by technical advancements. Technical efficiency has exhibited variability: specific locations have reported reductions, but others, such as Souss-Massa and Laâyoune-Saguia al Hamra, have seen significant advancements. These patterns indicate a progressive evolution of the growth drivers, yet regional differences persist, underscoring the necessity for customized solutions to mitigate gaps and foster balanced and inclusive growth. The findings indicate that capital accumulation and enhancements in technological efficiency had considerable potential to diminish regional inequities. Regions that have effectively amassed wealth and enhanced technological efficiency across two eras demonstrate tremendous success.

In contrast, areas with sluggish capital accumulation frequently have technological inefficiency despite potentially superior technical improvement. These insights underscore the necessity of enhancing investment strategies and advocating for policies that improve technical efficiency while disseminating the advantages of technological innovation in underdeveloped regions. These approaches are crucial for expediting convergence and sustainably diminishing regional differences.

Our examination of the growth of the 12 Moroccan regions from 2019 to 2020, utilizing a stochastic frontier approach, underscores three essential components for comprehending the dynamics of growth and convergence: variations in technical efficiency, advancements in technology, and the accumulation of physical capital. The findings indicate that variations in technical efficiency were the primary catalyst for development during the initial phase of the reforms. However, the accumulation of physical capital has emerged as the predominant factor after the onset of the 2010s. Conversely, the impact of technological advancement remains constrained and, at times, detrimental during the whole examined period.

Regarding regional convergence, alterations in technological efficiency emerge as the sole development element facilitating this convergence. Due to the dissemination of technical and institutional advancements, less developed countries generally see more rapid growth than their more sophisticated counterparts. Nonetheless, this beneficial impact progressively wanes with the progression of reforms and may become contingent. The State's engagement is entirely warranted by focusing its efforts on several fronts: the diffusion of technological advancements,

the development of human capital, economic liberalization, the mobility of production elements, and the establishment of physical and institutional infrastructures. The findings indicate that augmenting public investment is a viable method to enhance economic growth while fostering synergy with private investment. The effects of these investments differ by area; for instance, inequalities have intensified in areas like Drâa-Tafilalet and Souss-Massa. Conversely, the modeling results about region-specific investments indicate favorable enhancements in economic trajectories. This strategy has mitigated inequities across all areas, owing to investment quantities customized to each area's requirements and characteristics.

Keywords: Infrastructure, Allocative Efficiency, General Equilibrium and Welfare Economic Analysis of Regional Economies, Morocco.

Jel-classification : H54, D61,C68, R13, O47.