



# Expansion Effects of Higher Education Liberalization on the Regional Distribution of Universities and Educational Attainment in Zambia

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## Abstract

This study addresses the research question: What is the effect of higher education liberalization on the regional distribution of universities and educational attainment in Zambia? The analysis captures the transformative effects of liberalization policies on educational access and regional distribution using data from the Demographic and Health Survey (DHS) across seven of Zambia's ten provinces. We compare regions that established new universities with those that did not, estimating the average treatment effects on educational attainment among a total sample size of 23,065 individuals. This paper highlights the critical role of liberalization in fostering educational attainment by contextualizing the findings in Martin Trow's Theory of Educational Expansion, which outlines transitions from elite to universal education access. The regression results demonstrate the effect of university establishment on educational attainment over a specific period, starting in 2001. The findings reveal that until 2007, new universities did not result in a statistically significant difference in educational attainment levels between the treated and non-treated regions ( $p = 0.237$ ). However, by 2013, there was evidence of a small yet statistically significant positive effect ( $p = 0.003$ ), which became even more pronounced by 2018. The results indicate that the establishment of new universities leads to an approximate 18% increase in educational attainment relative to the sample mean, highlighting a substantial positive impact of the intervention. The paper recommends that the government devise incentives to encourage the establishment of private universities in geographically disadvantaged areas to balance regional educational disparities by leveraging the unique geographical characteristics of these areas to attract students and enhance local educational

infrastructure.

## Subject Areas

Higher Education, Public Policy

## Keywords

Liberalization of Higher Education, Educational Attainment, Regional Distribution

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## 1. Introduction

This study provides an in-depth analysis of the relationship between higher education liberalization, regional university distribution, and educational attainment in Zambia. Using nationally representative data from the Demographic and Health Survey (DHS) conducted across seven of Zambia's ten regions, the analysis traces the evolution of higher education access and institutional development. To contextualize these shifts, the paper presents graphical illustrations of population growth and the expansion of universities between 1990 and 2018.

The global expansion of higher education has accelerated rapidly in recent decades. According to [1], global student enrollment rose from 97 million in 2000 to an expected 262 million by 2025, placing increasing pressure on public education systems. In response, many countries have liberalized their higher education sectors, allowing private actors to enter the market and compete alongside public institutions. This trend has led to the proliferation of Private Higher Education Institutions (PrHEIs), which are now essential in absorbing excess demand and diversifying educational offerings [2] [3].

Liberalization in higher education refers to a policy-driven shift away from state monopoly, involving reforms that promote institutional autonomy, deregulation, market competition, and private sector participation [4]. These reforms often include changes in tuition policies, funding models, and quality assurance mechanisms, as well as public-private partnerships and industry-aligned curricula [5]. Governance structures also vary: public universities are typically state-controlled, while private universities are managed by independent entities, influencing their strategic direction and operations [6].

In Zambia, the liberalization of higher education formally began in 1997 with the enactment of the University Act No. 11, which allowed for the establishment and legal recognition of private institutions. Prior to this, the system was highly centralized and dominated by state-owned institutions that were financed and managed solely by the government [7]. This centralized approach led to inefficiencies and declining quality, primarily due to the government's limited capacity to invest adequately in infrastructure, staff, and student services [8] [9]. In response, the government initiated reforms to diversify financing and governance by opening

the sector to non-state actors [10].

Since then, the system has undergone rapid transformation. By 2020, Zambia had 9 public and 53 private universities, reflecting a substantial shift in the landscape of higher education provision [11]. This paper examines the effects of that transformation, with a particular focus on how the geographic expansion of universities has influenced educational attainment across regions.

### **Statement of the Problem**

The liberalization of higher education (HE) in Zambia has led to an increase in universities, particularly in urban areas such as Lusaka and the Copperbelt. However, this expansion has not been evenly distributed, with many rural and remote regions still lacking access to higher education institutions. This disparity raises concerns about equitable access to education, as students in economically marginalized areas have limited opportunities to advance their education and develop skills essential for social and economic mobility [9]. This study examines the effects of higher education liberalization on the regional distribution of universities and educational attainment in Zambia. By analyzing how liberalization has influenced access to universities in different regions, this research uncovers insights that could inform policies to promote equitable educational access. Ultimately, these findings can help support inclusive human capital development and balanced regional growth.

Research Question; What is the effect of higher education liberalization on the regional distribution of universities and educational attainment in Zambia?

## **2. Literature Review on University Expansion and Spatial Heterogeneity**

[12] examined how regional disparities in the distribution of colleges and universities in China affect equitable access to higher education. This study provides a detailed analysis of the evolution of China's higher education system, particularly since the late 1990s, emphasizing issues of distribution, opportunities, and resources. This research is highly relevant to the Zambian context, where similar regional disparities impact access to higher education. Insights from Hongmin's work, which highlighted China's transition from quantitative expansion to qualitative development, can inform analyses of Zambia's university distribution. By comparing these contexts, valuable lessons can be drawn on addressing regional inequality to enhance educational attainment. [12] critiqued the traditional scale-oriented approach to higher education, which emphasized regional heterogeneity in resource allocation, advocating instead for a high-quality development model aligned with national priorities. By linking the cultivation of high-quality talent to broader industrial and technological advancements, this study stresses the critical role of education in sustainable national development.

This perspective is particularly pertinent for Zambia, where addressing regional disparities in university distribution is essential for fostering equitable access and

producing a skilled workforce to drive the nation's socio-economic growth. The insights from China's shift toward quality-focused higher education development provide a valuable framework for examining and addressing similar challenges in Zambia. [13] examined university expansion in Kenya, focusing on quality education, challenges, and opportunities within both public and private universities. The study highlighted the strain on public universities due to the growing demand for higher education, resulting in issues such as overcrowding, inadequate teaching and learning facilities and insufficient student welfare services. Although private universities are somewhat better positioned, they also face challenges such as funding shortages and inefficient management. The authors emphasized the need for improved resource allocation, a restructured student loan scheme, investment in modern technology, and stronger collaboration between the government and private universities to ensure quality education for all qualified candidates.

This analysis is particularly relevant to Zambia, where similar challenges exist in terms of balancing access to higher education and maintaining quality. Public universities in Zambia face resource constraints that hinder their ability to accommodate an increasing number of students, often at the expense of educational standards. Drawing from Kenya's experience, Zambia can explore strategies such as diversifying funding sources, strengthening public-private partnerships, and leveraging technology to improve access and quality in higher education. Additionally, expanding university capacity and addressing regional disparities can help align Zambia's higher education sectors with national development goals.

Another similar study by [14] in Germany on universities' functions in knowledge transfer highlighted that while universities' functions in knowledge transfer have been extensively studied by scholars in various disciplines, there is still a need for a comprehensive understanding of their contributions at regional, national, and international levels. The study employs four conceptual frameworks to analyze the functions of universities in knowledge transfer: the regional innovation systems approach, the new production of technology theory, the triple helix model, and social network theory. These frameworks help to integrate university roles in local, regional, national, and international contexts. This multidimensional approach is the strength of this paper, as it allows for a more holistic understanding of how universities contribute to knowledge transfer.

Empirically, the paper reviews various methods used to investigate universities' relationships, including case studies, surveys, and social network analysis [14]. This paper's diverse methodologies are a significant feature, highlighting the range of techniques usable for knowledge transfer research. What stands out in this research is the incorporation of social network analysis, which underscores the significance of networks in understanding university functions related to knowledge transfer [14] [15] This study addresses the research question of how liberalization has impacted the spatial diversity of universities in Zambia, a consideration crucial for comprehending regional dynamics and filling knowledge gaps regarding the broader implications of universities' roles in knowledge transfer, particularly

from a regional and geographical perspective. This study aims to build on existing research that explores the roles of universities in transferring knowledge, offering new perspectives on the geographical and regional dimensions involved in this process.

### **Theoretical Framework: Martin Trow's Theory**

Martin Trow's Theory is a seminal framework in educational sociology. Trow's theory delineates the progression of higher education systems through three distinct phases: elite, mass, and universal access. Each phase reflects changes in societal demands, economic conditions, and policy decisions that shape who attends higher education institutions and the functions that these institutions serve.

#### ***Elite Phase***

In the elite phase, higher education is accessible only to a small but privileged segment of the population (up to 15%). This stage is about academic achievement and intellectual growth, generally serving the more affluent and influential members of society. Higher education institutions during this phase are often prestigious and selective, focusing on cultivating leaders and professionals who will assume influential positions in society. The primary function of universities is to preserve and transmit high culture, advanced knowledge, and professional skills [16] [17].

#### ***Mass Phase***

The mass phase marks a significant expansion of higher education, making it accessible to a larger portion of the population, ranging from 15% to 50%. Economic and social changes, such as industrialization and the growing need for a more educated workforce, drive this expansion. Higher education has become more inclusive, accommodating a broader range of academic abilities and socioeconomic backgrounds [18] [19]. The emphasis shifts from transmitting high culture to providing practical and vocational training. During this phase, the number of institutions and student enrollments substantially increases, reflecting the democratization of access to higher education [19].

#### ***Universal Phase***

In the universal phase of higher education, it is anticipated that almost the entire population of a society will have access to post-secondary education at some stage in their lives, typically when over 50% of citizens are enrolled. The progression of this phase is based on the understanding that higher education is a fundamental right essential for complete involvement in a knowledge-based economy [18]. The diversity of institutions and educational programs expands significantly to meet diverse student populations' varied needs and interests. Higher education institutions become more focused on lifelong learning, community service, and addressing societal challenges. The functions of higher education extend beyond academic and vocational training to include personal development, civic engagement, and social mobility.

Historically, during the elite phase, higher education in Zambia was limited to

a select few based on academic merit who could be enrolled at the then-only public university, the University of Zambia, and the Copperbelt University [18]-[20]. Currently, Zambia is experiencing the massification of higher education, characterized by efforts to broaden access and increase participation. This phase emphasizes expanding access to a larger group through initiatives such as scholarship, grants, and improved infrastructure. While Zambia is not yet in the universal phase, current policies underscore the importance of higher education for all, aiming to adapt the population to social and technological changes and increase enrollment rates across all demographics [20] [21]. The liberalization of higher education in Zambia has affected the regional distribution of universities and educational attainment. During the elite phase, access was restricted, but the mass phase of liberalization likely led to the establishment of universities in previously underserved regions, aligning with Trow's mass phase by providing greater access to education across the country. As Zambia progresses, the focus remains on ensuring that all regions have access to quality higher education to prepare the entire population for ongoing social and technological changes [2] [19]. Various factors influence students' choices between public and private universities. Demographic factors, such as age, gender, and socio-economic status, play a significant role in decision-making process [22] [23]. In line with Martin Trow's theory, as higher education becomes more massified, these factors may remain influential. Social factors, including peer influence, family expectations and cultural norms, also impact university choice, with policies aiming to address disparities in these areas to ensure equitable access. Additionally, institutional factors such as reputation, program offerings, and affordability significantly affect student preferences. Policies should focus on enhancing the reputation and quality of public and private universities to attract more students and provide a more balanced and accessible higher education landscape [16] [20].

### 3. Methodology and Design

In analyzing the research question on the effects of liberalization on the regional distribution of universities on educational attainment, the Difference-in-Differences model (DiD) was used. The treatment and control groups were carefully defined. The treatment group consists of regions within Zambia that have experienced the establishment of a new university since 1997 when the policy came into effect, while the control group comprises regions without a university in the year of the assessment.

To validate the DiD analysis, this study verified the assumption of parallel trends assumption. This assumption suggests that in the absence of the treatment, which is the establishment of new universities in this context, the average educational attainment for the treatment and control groups would follow a parallel trend over time [24] [25]. Considering that new universities were not established simultaneously; this necessitated employing a Staggered DiD. In the analysis, a Two-Way Fixed Effects (TWFE) regression within a staggered DiD framework is used to

estimate the causal impact of the introduction of new universities across various regions on educational attainment, controlling for both time-invariant university characteristics and common temporal shocks while accounting for the varying implementation years of the liberalization policy.

Drawing upon previous methodologies, such as the research conducted by [26], which utilized a TWFE model to estimate the causal impact of a program designed to reduce the distance to university campuses in Uruguay. The author begins by presenting evidence that distance influences enrollment, demonstrating that a 100 km increase in distance to the campus leads to a 0.09 percentage point reduction in the proportion of enrolled students, thus implying an approximately 8% decrease from the pre-treatment average. Employing a staggered DiD regression that capitalizes on the variation in treatment timing across localities, the analysis is carried out at the level of individual localities, estimating the average effect of the program on university enrollment, intergenerational mobility, and degree completion. The empirical approach categorizes each locality at time  $t$  into one of three groups: untreated (no new campuses have ever been opened), to be treated (no campus has been opened yet, but it will be in due course), and to be treated (new campuses have already been opened) [27]. Individuals are assigned to localities based on their residence before university enrollment. The TWFE model in this study makes it possible to control for both time-invariant unobserved characteristics of the localities and standard shocks that affect all localities over time. This approach helps isolate the causal effect of the program by considering potential confounding factors that could introduce bias to the estimates. Similarly, in DiD analysis, using a TWFE regression helps control for time-invariant and common time-varying factors, yielding more robust estimates of the desired causal effect.

Another study by [28] used a DiD design to assess the impacts of the nationwide expansion of higher education in Vietnam. The study compares provinces that had never previously possessed a university with those that had established a new university for the first time during the study period, observing various birth cohorts. The primary analytical model employed is a standard DiD model, where the treatment variable indicates whether a province has established a university for the first time, and the exposure variable denotes whether the birth cohort reached college-going age during the expansion period. The model incorporates province-by-year and cohort fixed effects, controlling individual characteristics such as age, squared age, and gender. Similarly, this study also accounts for potential covariates that could influence educational attainment, such as age, gender, and internal migration across regions. This study addresses potential threats to the parallel trends assumption, such as the non-random nature of university establishments and selective migration. The robustness of the results was also checked using a change-in-changes (CiC) model to relax the assumption of parallel trends. Additionally, this study considers the staggered timing of university openings and uses cluster-robust inference to address concerns regarding estimation and inference with some treated clusters. The results indicate that expanding

HE increased the probability of completing college, employment, and wages for exposed individuals. This study also calculates the implied returns to college education among “switchers” who chose to complete college education due to the expansion and finds substantial returns. In this study, adopting a DiD (design offers valuable insights into the impact of university establishment. This methodology effectively addresses the challenge of parallel trends and employs suitable estimation and inference approaches to accommodate staggered treatment timing and a limited number of clusters.

A similar study by [29] evaluated the effects of a program in Uruguay that expanded post-secondary education infrastructure by building university campuses across the country. The methodology uses TWFE regression and administrative records to assess the program’s causal impact, leveraging temporal and geographic variations in program implementation. The study found that the program increased university enrollment, particularly among less privileged students, reduced spatial inequality, and did not lower university completion rates. Furthermore, it positively impacted high school and labor market outcomes in the affected localities. This study contributes to the literature on the role of public policies in educational attainment.

Drawing on previous studies, this study examines the impact of liberalization policies on the regional distribution of universities and educational attainment in Zambia. The TWFE model was used in the analysis. **Table 1** presents the frequency of individuals in the targeted regions in the control and treatment groups. When assigning provinces to either group, those with established universities were designated the treatment group, whereas those without were assigned to the control group. The establishment of universities occurred gradually, with the first being established in the Southern province in 2003, followed by the Central province in 2007 and the western province in 2012. These provinces constituted the treatment group, whereas the Northern, Luapula, and Northwestern provinces, lacking a university, formed the control group. The baseline year for the analysis was 2001, with the final evaluation in 2018. The provinces of Lusaka and Copperbelt were excluded from the analysis because they already had universities before the liberalization policy was implemented. The analysis included 23,065 observations.

### **Justification of Variables in the Model**

Educational attainment is an essential dependent variable of interest that reflects the highest level of education a person has completed; it is essential for evaluating the effect of creating universities in regions. It is a critical indicator of socio-economic outcomes directly linked to employment prospects, income potential, and overall economic development. Additionally, educational attainment captures the long-term effects of such educational investments on individuals and regions. By analyzing changes in this variable, we assess the degree to which the establishment of higher education institutions influences the educational opportunities and contributes to closing educational gaps, fostering equity, and enhancing social

**Table 1.** Sample region distribution.

| Region        | Year  |       |       |       | Total  |
|---------------|-------|-------|-------|-------|--------|
|               | 2001  | 2008  | 2012  | 2018  |        |
| Central       | 569   | 480   | 1765  | 480   | 3294   |
|               | 17.27 | 14.57 | 53.58 | 14.57 | 100.00 |
| Eastern       | 278   | 918   | 735   | 1851  | 3782   |
|               | 7.35  | 24.27 | 19.43 | 48.94 | 100.00 |
| Luapula       | 742   | 671   | 397   | 1992  | 3802   |
|               | 19.52 | 17.65 | 10.44 | 52.39 | 100.00 |
| North western | 1168  | 1018  | 363   | 108   | 2657   |
|               | 43.96 | 38.31 | 13.66 | 4.06  | 100.00 |
| Northern      | 649   | 444   | 644   | 1732  | 3469   |
|               | 18.71 | 12.80 | 18.56 | 49.93 | 100.00 |
| Southern      | 681   | 387   | 1333  | 889   | 3290   |
|               | 20.70 | 11.76 | 40.52 | 27.02 | 100.00 |
| Western       | 374   | 333   | 820   | 1244  | 2771   |
|               | 13.50 | 12.02 | 29.59 | 44.89 | 100.00 |
| Total         | 4461  | 4251  | 6057  | 8296  | 23065  |
|               | 19.34 | 18.43 | 26.26 | 35.97 | 100.00 |

Source: Authors' computation.

mobility within the regions [30]. Therefore, it provides a meaningful gauge of the treatment effect of the liberalization policy. We include gender as a control variable, there can be significant gender disparities in educational attainment due to historical, cultural, societal, and policy-related factors. For example, in some contexts, one gender might have more opportunities to pursue higher education than the other. Gender can also influence the choice of study field, the level of education pursued, and the educational outcomes achieved. By controlling for gender, we account for these systemic differences and more accurately assess the effect of other variables on educational attainment [31]. Age: Education is a process that generally follows a certain age trajectory: primary, secondary, and tertiary education correspond to increasing age levels. Age also captures time effects, where different age groups might have had different access to educational resources or policies throughout their lives. Moreover, educational attainment can change over a person's life as they may pursue further education later in life. Including age controls for these factors. Internal migration refers to the movement of people from one region within a country to another. Internal migration can affect educational attainment as it might reflect access to better educational resources, economic opportunities, or other factors related to the quality and accessibility of education [32]. The number of universities offers a proxy for access to higher education

within a region. Regions with more universities might provide more opportunities for higher educational attainment, not just through direct access to education but also through associated benefits like research opportunities, academic networking, and regional economic development that can prioritize education.

To address potential gender disparities in educational attainment that may arise from historical, cultural, societal, and policy-related factors, the analysis incorporates gender as a control variable. In certain contexts, one gender may have greater access to pursue higher education. Moreover, gender can play a role in determining the choice of study field, the level of education pursued, and the resulting outcomes. By including gender as a control variable, the study considers these systemic differences and provides a more precise assessment of the impact of other variables on educational attainment [31].

$$y_{it} = \alpha_i y_t + \beta D_{it} + X'_{it} \delta + \varepsilon_{it}$$

- $Y_{it}$  is the outcome variable for unit  $i$  at time  $t$ .
- $\alpha_i$  is the unit fixed effect, capturing time-invariant characteristics of each unit.
- $\gamma_t$  is the time-fixed effect, capturing standard shocks or trends affecting all units at time  $t$ .
- $D_{it}$  is the treatment variable, which takes the value 1 if unit  $i$  is treated at time  $t$ , and 0 otherwise. The treatment is staggered, meaning that different units receive the treatment at different times.
- $X'_{it}$  is a vector of time-varying control variables.
- $\delta$  is a vector of coefficients for the control variables.
- $\varepsilon_{it}$  is the error term.
- The coefficient of interest is  $\beta$ , which measures the average treatment effect of the staggered treatment on the outcome variable.

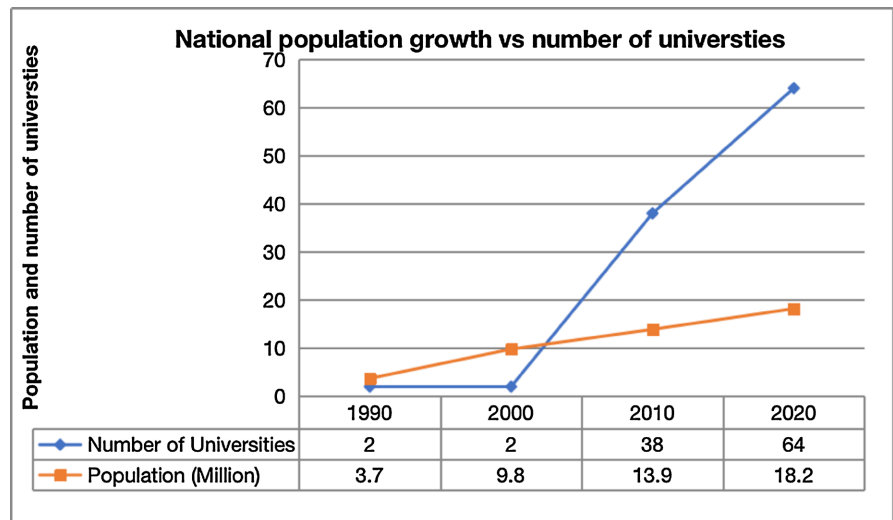
## 4. Findings

### 4.1. 1990-2020 Regional University Distribution against Population Growth

**Figure 1** depicts the relationship between the growth of the national population and the proliferation of universities in Zambia from 1990 to 2020. In 1990, when the population stood at 3.7 million, only 2 universities indicated the early stages of higher education development. Despite a significant population increase to 9.8 million by 2000, the number of universities remained stagnant at 2, revealing the rising demand for higher education despite limited institutional capacity. This disparity, highlighted by the expanding population, underscores the mounting pressure on university accessibility during this period. Notably, a transformative shift occurred in 2010, precipitated by the liberalization of higher education policy in 1997. This pivotal moment witnessed a remarkable surge in universities, with their numbers soaring to 38, coinciding with a country's population of 13.9 million. This surge intensified further in 2020, as the number of universities expanded to 64, in tandem with the country's population reaching 18.2 million. This robust dataset underscores a significant transformation in Zambia's higher education

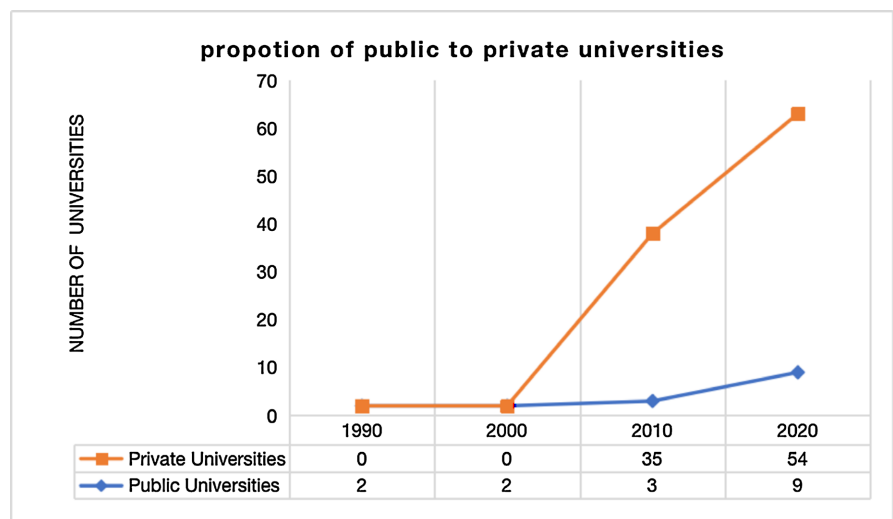
environment, indicating an enhanced responsiveness to the escalating demand for university education over a span of two decades.

The liberalization of HE in Zambia has led to a significant increase in the number of private universities, resulting in a major transformation of the HE sectors. **Figure 2** shows that before 2000, the country had only two public universities. However, after the liberalization, the period from 2000 to 2010 witnessed remarkable growth, with the establishment of 35 private universities and a modest increase in public universities to three. The subsequent decade, from 2010 to 2020, marked an even more remarkable expansion, as the number of public universities more than tripled, while private universities soared to 53. This transformational shift had culminated in 63 universities by 2020. The implications of this



Source: Authors' elaboration.

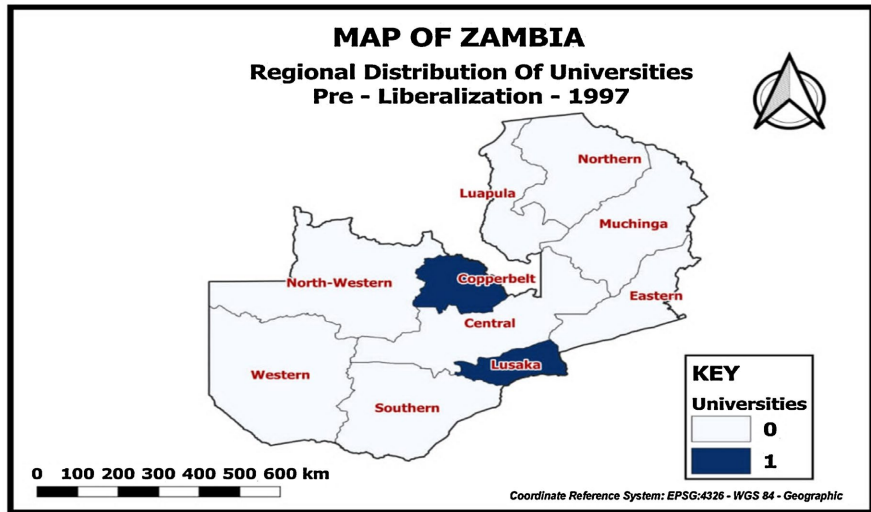
**Figure 1.** Regional university distribution against population growth.



Source: Authors' elaboration.

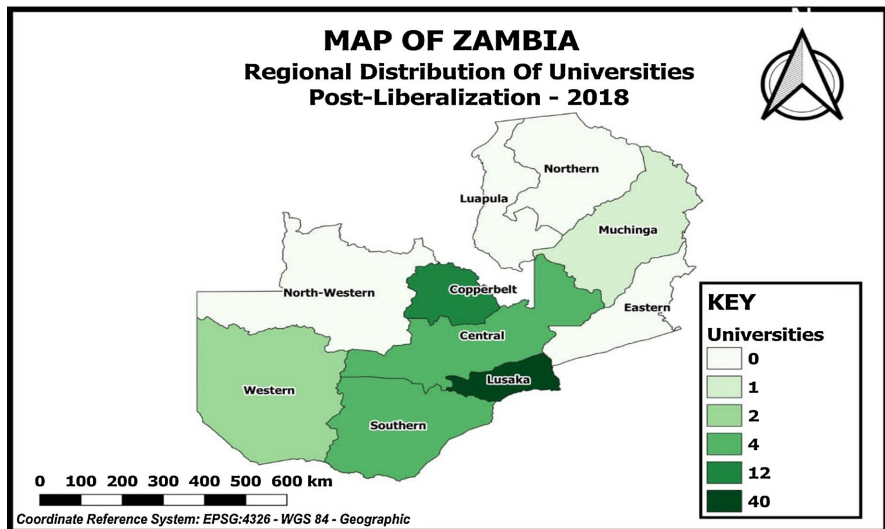
**Figure 2.** Proportion of public to private universities.

significant growth in private university establishments are far-reaching, as it signifies a diversification of the higher education sector and has the potential to impact accessibility, educational approaches and overall educational attainment. This transformative trend highlights the evolving dynamics of higher education in response to liberalization policies.



Source: Authors' elaboration.

Figure 3. Regional distribution of universities before liberalization<sup>1</sup>.

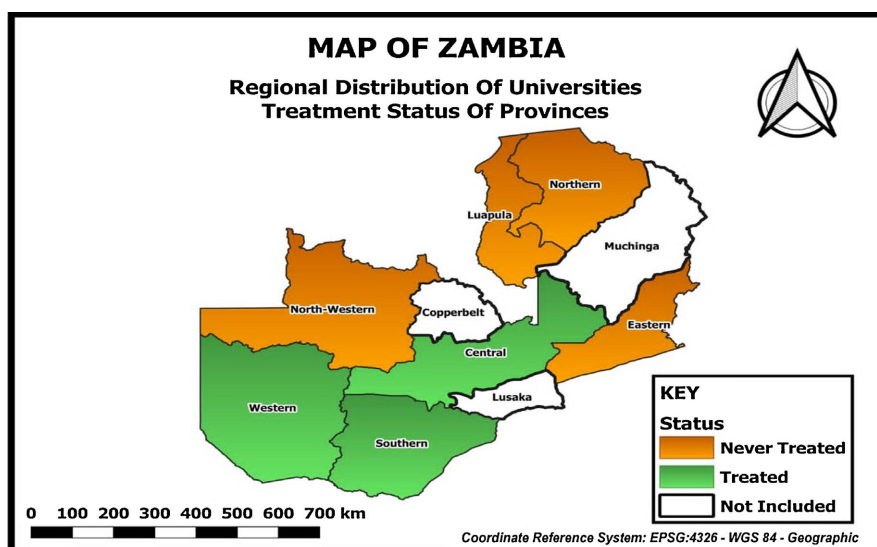


Source: Authors' elaboration.

Figure 4. Regional distribution of universities pre and post liberalization<sup>2</sup>.

<sup>1</sup>Figure 3 map shows that there were only two public universities prior to the liberalization of higher education in 1997, located in the Lusaka and Copper Belt provinces.

<sup>2</sup>Figure 4 indicates that by the year 2018, Zambia witnessed heterogeneous distribution of universities, with the majority concentrated in Lusaka province, amounting to 40. Additionally, there were 12 in the Copperbelt province, 4 in the Southern province, 4 in the Central province, 1 in Muchinga, and 2 in the Western province. Notably, the North Western, Luapula, Northern, and Eastern provinces did not host any universities during this period, suggesting regional disparities in higher education infrastructure.



Source: Author elaboration.

**Figure 5.** Treatment status of provinces<sup>3</sup>.

## 4.2. Descriptive Statistics

The descriptive statistics of the variables considered are presented in **Table 2**, the average age of the sample was approximately 35 years, with a standard deviation indicating a range of approximately 16 years around the mean, ranging from 15 to 49 years old. The gender distribution was almost equal, with a mean demonstrating an equal split (50-50) between the coded categories representing males and females. The dependent variable educational attainment has a mean of around 7.6, with various values indicating diverse educational levels within the sample. The variable for internal migration has a negative mean, indicating a net out-migration in the sample or a coding mechanism where negative values correspond to the average number of individuals migrating from the treated regions.

**Table 2.** Descriptive Statistics.

| Variable               | Obs    | Mean   | Std. Dev. | Min   | Max  |
|------------------------|--------|--------|-----------|-------|------|
| Age                    | 23,065 | 35.37  | 8.177     | 15    | 49   |
| Gender                 | 23,065 | 0.499  | 0.5       | 0     | 1    |
| Edu_attainment         | 23,065 | 7.628  | 2.823     | 1     | 21   |
| Internal migration     | 23,065 | -4.696 | 6.511     | -14.2 | 12.6 |
| Number of universities | 23,065 | 0.587  | 0.915     | 0     | 4    |
| Treatment (d)          | 23,065 | 0.321  | 0.467     | 0     | 1    |

Source: Authors' computations.

<sup>3</sup>**Figure 5** shows the treated regions, which are those where a new university was established after the liberalization of higher education. Never-treated regions are those that never had a university established following the liberalization. Regions that already had universities at the time of the liberalization were excluded from the difference-in-differences analysis. Muchinga Province was also excluded because it was a newly established province in 2011.

the data demonstrate significant variability. Finally, the average number of universities in the regions is less than one, with some areas having up to four. In contrast, the remaining respondents reported no access to higher education institutions across the sample.

### 4.3. Cross-Tabulation by Year and Region

**Table 3** presents a cross-tabulation of the distribution of observations by region and academic year. The data covers five specific years, with 2001 as the baseline year because of the initiation of treatment establishment at the first university in the initial treatment region in 2003. The frequencies and corresponding percentages represent the distribution of observations across regions during the selected years. In 2001, there was a higher concentration of observations in the northwestern region (26.18%), whereas the central region had the lowest percentage (12.75%). The distribution shifts in subsequent years, with 2013 exhibiting the highest concentration of observations in the central region (29.14%) and the northwestern region accounting for only 1.30% of the observations. In 2018, the Luapula region had the highest percentage (24.01%), while the northwestern region had the lowest representation.

**Table 3.** Tabulation of year region.

| Year  | Region  |         |         |               |          |          |         | Total  |
|-------|---------|---------|---------|---------------|----------|----------|---------|--------|
|       | Central | Eastern | Luapula | North western | Northern | Southern | Western |        |
| 2001  | 569     | 278     | 742     | 1168          | 649      | 681      | 374     | 4461   |
|       | 12.75   | 6.23    | 16.63   | 26.18         | 14.55    | 15.27    | 8.38    | 100.00 |
| 2007  | 480     | 918     | 671     | 1018          | 444      | 387      | 333     | 4251   |
|       | 11.29   | 21.59   | 15.78   | 23.95         | 10.44    | 9.10     | 7.83    | 100.00 |
| 2013  | 1765    | 735     | 397     | 363           | 644      | 1333     | 820     | 6057   |
|       | 29.14   | 12.13   | 6.55    | 5.99          | 10.63    | 22.01    | 13.54   | 100.00 |
| 2018  | 480     | 1851    | 1992    | 108           | 1732     | 889      | 1244    | 8296   |
|       | 5.79    | 22.31   | 24.01   | 1.30          | 20.88    | 10.72    | 15.00   | 100.00 |
| Total | 3294    | 3782    | 3802    | 2657          | 3469     | 3290     | 2771    | 23065  |
|       | 14.28   | 16.40   | 16.48   | 11.52         | 15.04    | 14.26    | 12.01   | 100.00 |

The first row shows the *frequencies*, and the second row shows the *row percentages*. Source: Authors' Computation.

### 4.4. Two-Way Fixed Effect Regression (TWFE)

The regression results in **Table 4** demonstrate the effect of university establishment on educational attainment over a specific period, starting in 2001. The findings reveal that until 2007, new universities did not result in a statistically significant difference in educational attainment levels ( $p = 0.237$ ). However, by 2013,

there was evidence of a small yet statistically significant positive effect ( $p = 0.003$ ), which became even more pronounced by 2018. This suggests that establishing universities significantly and positively impacted educational attainment in the regions where they were introduced.

Furthermore, the covariate “internal migration” was significantly associated with educational attainment, exhibiting a negative correlation ( $p < 0.001$ ). This finding implies that individuals migrating within a country tend to have lower educational attainment in countries where they are treated. On the other hand, gender and age did not significantly influence educational attainment in this study. Establishing universities was a significant determinant of educational attainment, indicating that regions with new universities experienced an overall increase in educational attainment while controlling for other factors ( $p < 0.001$ ). The model used in this study accounted for approximately 45% of the variability in educational attainment, indicating strong explanatory power.

**Table 4.** TWFE regression results.

| Attainment         | Coef.    | St.Err. | t-value           | p-value | [95%<br>Conf | Interval] | Sig |
|--------------------|----------|---------|-------------------|---------|--------------|-----------|-----|
| Treatment(d)       | 1.377    | .032    | 43.62             | 0       | 1.315        | 1.439     | *** |
| Gender             | 0.009    | 0.035   | 0.27              | 0.787   | -0.059       | 0.077     |     |
| Age                | 0.002    | 0.002   | 0.89              | 0.371   | -0.002       | 0.006     |     |
| Internal migration | -0.065   | 0.004   | -18.40            | 0       | -0.072       | -0.058    | *** |
| 2001b              | 0.025    | 0.064   | 0.39              | 0.698   | -0.1         | 0.149     |     |
| 2007o              | 0.102    | 0.086   | 1.18              | 0.237   | -0.067       | 0.27      |     |
| 2013o              | 0.015    | 0.005   | 2.93              | 0.003   | 0.005        | 0.026     | *** |
| 2018o              | 4.94     | 0.038   | 130.89            | 0       | 4.866        | 5.014     | *** |
| Constant           | 6.442    | 0.085   | 75.42             | 0       | 6.274        | 6.609     | *** |
| Mean dependent var | 7.628    |         | SD-dependent var  | 6.511   |              |           |     |
| R-squared          | 0.450    |         | Number of obs     | 23,065  |              |           |     |
| F-test             | 4708.412 |         | Prob > F          | 0.00    |              |           |     |
| R-squared within   | 0.75     |         | R-squared between | 0.65    |              |           |     |

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Source: Authors' computations.

### Robustness Tests

#### *Robust Check Bootstrap 1000 Replications*

This study uses the bootstrap method when evaluating a two-way fixed effects model because of its nonparametric nature. This approach provides robustness against assumption violations, such as the normality of residuals, which are frequently encountered in the TWFE model (Efron & Tibshirani, 1994). The bootstrap method helps estimate accurate standard errors and coefficient confidence intervals,

offering more reliable outcomes than traditional parametric approaches. This is particularly true for small samples or complex model structures [33]. Additionally, the bootstrap method addresses issues of heteroskedasticity and autocorrelation, both prevalent in panel data, by resampling observations in a manner consistent with the observed data's structure. As a result, it enhances the validity of inferential statistics [34]. **Table 5** shows that the robustness check using the bootstrap method supported the significant results of the original TWFE analysis. By resampling the data to validate the precision of the regression coefficients, this method yielded a Wald chi-square statistic of 2275.81 with a p-value of less than .0001. This reaffirms the overall significance of the model. These results, confirmed through rigorous testing against sample variations, underscore the stability and reliability of the significant relationships observed in the analysis.

**Table 5.** Robust Check Bootstrap 1000 Replications.

| (running regress on estimation sample) |             |          |         |           |              |        |
|--|-------------|----------|---------|-----------|--------------|--------|
| Bootstrap replications (1000)          |             |          |         |           |              |        |
| Number of obs = 23,065                 |             |          |         |           |              |        |
| Replications = 1000                    |             |          |         |           |              |        |
| Wald chi <sup>2</sup> (4) = 2275.81    |             |          |         |           |              |        |
| Prob > chi <sup>2</sup> = 0.0000       |             |          |         |           |              |        |
| R-squared = 0.4327                     |             |          |         |           |              |        |
| Adj R-squared = 0.4325                 |             |          |         |           |              |        |
| Root MSE = 2.6289                      |             |          |         |           |              |        |
|  |             | Observed |         | Bootstrap | Normal-based |        |
| Attainment                             | Coefficient | std.     | err.    | z         | P > z        | [95%   |
| Treatment (d)                          | 1.377       | 0.033    | 41.810  | 0.000     | 1.312        | 1.442  |
| Gender                                 | 0.009       | 0.034    | 0.270   | 0.785     | -0.058       | 0.076  |
| Age                                    | 0.002       | 0.002    | 0.890   | 0.374     | -0.002       | 0.006  |
| Internal migration                     | -0.065      | 0.004    | -14.770 | 0.000     | -0.074       | -0.057 |
| _cons                                  | 6.442       | 0.085    | 75.890  | 0.000     | 6.275        | 6.608  |

Source: Authors' computations.

#### ***Robust Check Test: Placebo Effect***

The study employed a robust test for placebo effects to demonstrate that the findings were not merely due to model specifications or peculiarities in the sample (Midi *et al.*, 2010). The lack of a significant coefficient for the placebo treatment implies that the model does not detect false treatment effects during periods or in groups in which the treatment should have no impact. This enhances confidence in the validity of the significant treatment effects observed during the actual treatment periods. The findings indicate that significant independent variables such as internal migration and treatment universities maintain their significance in influencing educational attainment, reaffirming their importance irrespective of

placebo treatment. In summary, the results of the placebo test support the robustness of the actual treatment effects identified in the original two-way fixed and bootstrap analyses, thereby strengthening the reliability and validity of the model.

The outcome variable in this analysis is educational attainment, and the treatment is the policy of liberalization, specifically denoted by the introduction of a new university. In the placebo test for 2001, which represents a period without the introduction of the new university, the coefficient was 0.025, and the p-value was 0.678. The high p-value (0.678) indicates that we fail to reject the null hypothesis, meaning that there is no statistically significant evidence that the year 2001 had any effect on educational attainment. The small, non-significant coefficient (0.025) indicates that any observed effect in 2001 was likely due to random chance rather than a true causal relationship.

The lack of a significant effect during the placebo period (2001) provides confidence that any significant effects observed during the actual treatment period are less likely to be due to random variations. If the placebo period had shown a significant effect, it would indicate potential issues with the model or the presence of confounding factors, indicating that the results in the treatment period might also be spurious. In summary, **Table 6** indicates the high p-value (0.678) and the small, non-significant coefficient (0.025) for 2001 indicate that there was no meaningful relationship between the year 2001 and educational attainment in this placebo test. This supports the validity of the model by demonstrating that the

**Table 6.** Placebo effect.

| Edattainment          | Coef.  | St.Err.    | t-     | p-value              | [95%<br>Conf | Interval]  | Sig |
|-----------------------|--------|------------|--------|----------------------|--------------|------------|-----|
| Placebo<br>treatment  | 0.217  | 2.629      | 0.08   | 0.934                | -4.937       | 5.37       |     |
| (d)                   | 1.377  | 0.025      | 54.43  | 0                    | 1.327        | 1.427      | *** |
| 2001                  | 0.025  | 0.064      | 0.39   | 0.678                | -0.1         | 0.149      |     |
| Gender                | 0.009  | 0.035      | 0.27   | 0.788                | -0.059       | 0.077      |     |
| Age                   | 0.002  | 0.002      | 0.89   | 0.372                | -0.002       | 0.006      |     |
| Internal<br>migration | -0.065 | 0.004      | -18.40 | 0                    | -0.072       | -0.058     | *** |
| Constant              | 6.442  | .084       | 76.89  | 0                    | 6.277        | 6.606      | *** |
| Mean dependent var    |        | 7.628      |        | SD-dependent var     |              | 2.823      |     |
| R-squared             |        | 0.133      |        | Number of Obs        |              | 23065      |     |
| F-test                |        | 705.550    |        | Prob > F             |              | 0.000      |     |
| Akaike crit. (AIC)    |        | 110050.579 |        | Bayesian crit. (BIC) |              | 110098.855 |     |

\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1. Source: Authors' computations.

observed effects during the actual treatment period are less likely to be driven by random chance or confounding factors.

***Robust Check: Sensitivity Test for Outliers***

To further validate the results of the two-way fixed effect, the robustness of the results was tested using a sensitivity test of the results to outliers; **Table 7** and **Table 8** presents a regression analysis to evaluate the robustness of the two-way fixed effect model in the face of outliers. Analysis is critical for ensuring that the model's findings are not unduly influenced by extreme values that could skew the results [35]. After removing the outliers, the number of observations in the dataset decreased from 23,065 to 20,687, indicating that a cleaning process was performed to mitigate the impact of outliers on the model's estimates. Despite this reduction in the number of data points, the statistical significance of the variables within the model remained unchanged.

Notably, the variable "internal migration" retained a highly significant negative relationship with educational attainment, with a coefficient of  $-0.038$  and a p-value of 0. This robustness indicates that internal migration consistently correlates with decreased educational attainment, regardless of outliers. Similarly, the "treatment variable" maintained a significant positive coefficient of  $0.837$ , with a p-value of 0, indicating the strong positive effect of establishing universities on educational attainment, even after outlier adjustment. The constant term of the model, which provides a baseline level of educational attainment when all other variables are held constant, also remained significantly positive, with a value of  $6.456$  and a p-value of 0. This indicates that the model has a stable intercept term, which reinforces the significance value of the F-test of the model's baseline predictions after post-outlier cleaning. The R-squared value is  $0.401$ , indicating that the model explains approximately 40% of the variance in educational, a substantial

**Table 7.** Robust check: sensitivity test for outliers.

| ed_ attainment          | Coef.  | St.Err.    | t-value              | p-value | [95%<br>Conf | Interval] | Sig |
|-------------------------|--------|------------|----------------------|---------|--------------|-----------|-----|
| Treatment(d)            | 0.837  | 0.019      | 43.02                | 0       | 0.799        | 0.875     | *** |
| Gender                  | 0.001  | 0.023      | 0.04                 | 0.964   | -0.045       | 0.047     |     |
| Age                     | 0.002  | 0.001      | 1.35                 | 0.176   | -0.001       | 0.005     |     |
| International migration | -0.038 | 0.003      | -14.36               | 0       | -0.043       | -0.033    | *** |
| Constant                | 6.456  | 0.058      | 111.36               | 0       | 6.343        | 6.57      | *** |
| Mean dependent var      |        | 7.156      | SD-dependent var     |         | 1.774        |           |     |
| R-squared               |        | 0.401      | Number of Obs        |         | 20687        |           |     |
| F-test                  |        | 577.836    | Prob > F             |         | 0.000        |           |     |
| Akaike crit. (AIC)      |        | 80,243.711 | Bayesian crit. (BIC) |         | 80,283.397   |           |     |

\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1. Source: Authors' computations.

**Table 8.** Significance levels with and without outliers.

| Variable           | original | cleaned |
|--------------------|----------|---------|
| Treatment (d)      | 0.837    | 0.837   |
|                    | 0.000    | 0.000   |
| Gender             | 0.001    | 0.001   |
|                    | 0.965    | 0.965   |
| Age                | 0.002    | 0.002   |
|                    | 0.176    | 0.176   |
| Internal migration | -0.038   | -0.038  |
|                    | 0.000    | 0.000   |
| _cons              | 6.456    | 6.456   |
|                    | 0.000    | 0.000   |

Legend: b/p. Source: Authors' computation.

amount considering the typical complexities involved in educational data. The F-test, which obtained a significant value, confirmed the model's overall statistical validity even after removing outliers.

#### 4.5. Discussion on Effect of Regional University Distribution on Educational Attainment

The statistical analysis of the effects of higher education liberalization on the regional distribution of universities and educational attainment in Zambia has revealed that liberalization significantly impacts the regional distribution of universities and educational attainment. The findings indicate that liberalization policies have spurred changes in the higher education sector, potentially influencing universities' locations and subsequent levels of educational attainment. Additionally, the results reveal a time-lagged effect where the benefits of HE expansion manifest slowly but may take several years to materialize as institutions become established, programs are developed, students graduate and the regional economy adapts to absorb higher-educated individuals [23].

This finding highlights the importance of long-term planning and patience in higher education policy. Similarly, previous studies have emphasized the distinction between quantitative expansion and qualitative development in higher education [12]. The initial lack of a significant effect of the two-way fixed effect regression on educational attainment by 2007 reflects the initial phase of quantitative growth, in which the focus is on building infrastructure and increasing enrollment. By 2013 and more strongly by 2018, the positive effects on educational attainment indicate a transition to qualitative development where the emphasis shifts toward the quality of education and its outcomes. This mirrors the evolution described by Hongmin, who stated that the Chinese higher education system underwent a shift from rapid expansion to focusing on quality and equity.

The negative correlation between internal migration and educational attainment might indicate a brain drain where educated individuals leave their home regions, reducing the average educational level. Alternatively, it could reflect the movement of individuals to areas with better educational opportunities, which would not necessarily imply a loss for the origin regions if overall access and quality of education are improving. This resonates with the concerns about equitable distribution and access that have been highlighted in the literature.

Gender and age were not significant factors, but they demonstrate that the positive impact of university establishment is relatively uniform across these demographics. The fact that establishing universities is an essential determinant of educational attainment after controlling for other factors aligns with literature that shows the importance of regional distribution of educational resources in facilitating access to higher education [12]. This confirms the role of universities as catalysts for regional development, not only through direct educational outcomes but also through indirect economic and social benefits. This study provides valuable insights into the effects of liberalization on the distribution of universities and educational attainment in Zambia. The research findings align with the insights provided by Hongmin's study in 2007, which explored the regional distribution of colleges and universities in China and its implications for equal access to higher education. Hongmin's work serves as a valuable backdrop, offering a well-structured analysis of the evolution of higher education in China, particularly emphasizing the heightened attention to distribution, opportunities, and Resources within the sector since the late 1990s. The findings resonate with [12] emphasis on the critical role of university distribution in shaping educational outcomes.

Trow's Theory of Higher Education, which outlines the transition from elite to mass and eventually universal access, provides a valuable framework for understanding Zambia's higher education landscape. Zambia is firmly positioned in the mass phase, with liberalization policies driving increased participation and regional expansion. However, challenges such as unequal distribution of universities, socio-economic disparities, and financial constraints persist, hindering the transition to the universal phase. Statistical analyses reveal that liberalization significantly impacts the regional distribution of universities and educational attainment, but these effects are time-lagged, requiring years for benefits to materialize as institutions establish themselves and integrate with local economies. This aligns with [12] findings on China's shift from quantitative expansion to qualitative development in higher education. Initially focused on infrastructure and enrollment, Zambia now faces the need to enhance the quality and equity of education, reflecting Trow's assertion that the mass phase demands not only increased access but also improved outcomes.

Based on these findings, regions grappling with the scarcity of universities face significant challenges in providing access to higher education, thereby limiting the educational opportunities available to individuals in those areas. This situation results in students residing in regions with limited university presence confronting

formidable barriers to pursuing higher education, ultimately adversely impacting their educational attainment. Furthermore, previous studies have highlighted the broader implications of university distribution disparities on economic and employment opportunities. For instance, argued that concentrating universities in specific regions fosters economic development, job opportunities, and overall growth. In contrast, regions with restricted access to universities need to attract more skilled professionals, which negatively impacts their economic growth.

## 5. Conclusions

This paper presents a comprehensive study of the effects of liberalization on university distribution and educational attainment in Zambia. Notably, the presence of universities in certain regions is linked to elevated educational outcomes, emphasizing their role in enhancing attainment levels. This study draws on Hongmin's research on the regional distribution of universities in China, which is aligned with the emphasis on the distribution's critical role in shaping educational outcomes. The cohort analysis revealed increased effects over time, with varying impacts observed in regions with new universities. The absence of universities in certain regions poses challenges to access higher education, affecting overall educational attainment. This study emphasizes the importance of considering distribution, opportunities, and resources when shaping educational outcomes. This highlights the effects of the unequal regional distribution of universities, with the majority concentrated in Lusaka and the Copperbelt Provinces. The unequal distribution of universities has broad economic and employment implications that influence regional development and migration patterns. Within the context of this research, these insights contribute to the ongoing discourse on the impact of higher education liberalization. This requires region-specific policies to address disparities and ensure equitable access to educational and economic opportunities across the country.

Martin Trow's Theory of higher education provides a framework for understanding the progression of higher education systems through three phases: elite, mass, and universal access. In the elite phase, access is limited to a privileged few, emphasizing intellectual growth and leadership cultivation. The mass phase marks the democratization of higher education, driven by economic and social needs, expanding access and vocational training. The universal phase envisions education as a fundamental right, with institutions addressing diverse societal needs. In Zambia, higher education has transitioned from the elite to the mass phase, with liberalization policies increasing the number of universities and improving access, particularly in underserved regions. However, disparities persist, with most universities concentrated in Lusaka and the Copperbelt Provinces, limiting opportunities in marginalized areas. Addressing these challenges requires region-specific policies, improved resource distribution, and financial aid to enhance educational attainment and promote equitable access across the country.

## 5.1. Limitations of the Study

The study emphasizes educational attainment measured in years of schooling, but it does not account for education quality. Therefore, improvements in attainment may not necessarily translate into educational quality. This limitation could be addressed in future studies.

## 5.2. Recommendation

The government should encourage universities to establish campuses in rural areas through tax incentives and grants to promote equitable access to education across regions.

## Conflicts of Interest

The authors declare no conflicts of interest.

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