IMPACT OF COUNTY ROAD INFRASTRUCTURE INVESTMENT ON EMPOLYMENT

BY

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DECLARATION

I declare that this Research project paper is my original work and that it has not been submitted to any other University for any degree award.

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Signature Date 30th November 2023

This Research project paper has been submitted for examination with my approval as the University Supervisor.

PROF. DAMIANO MANDA KULUNDU

Signature ……________…………………… Date……30th November 2023……….

DEDICATION

This work is dedicated to my family – the greater Nya'Kondo Lineage.

ACKNOWLEDGEMENT

I am deeply grateful to God for guiding me on this journey. Achieving this milestone would not have been possible without the invaluable support of numerous individuals, and I want to express my heartfelt thanks for their contributions.

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ABSTRACT

The current research aimed to delve into the empirical connection between the infrastructure investment at the county level and employment outcome in Kenya. To be more precise, the study endeavours to scrutinize how county road infrastructure influences employment. Additionally, the research aims to discern any sectorial disparities in the employment repercussions stemming from county road investments. Ultimately, the study intends to derive policy implications based on its findings. The study relied on an eight-year (2015-2022) panel data for six counties in Kenya collected from various data sources such as KNBS, IMF and a Fixed Effect model to achieve the objectives. Result reveals that our study does not find any evidence linking road infrastructural investment and gross county product to county employment outcome. However, there is enough evidence to support human services expenditure and education expenditure to boost and reduce county employment outcome respectively

CHAPTER I: INTRODUCTION

1.0.Introduction

Numerous efforts have been made over the years to empirically study whether or not investments in the infrastructure of road transportation can lead to job opportunities across an economy(Mohmand et al., 2017). Evidence from earlier studies is conflicting and equivocal. Previous research has often suffered from a number of methodological flaws, which could be one explanation (Mohmand et al., 2017).

Theoretically, improvements in transportation infrastructure may change firm and household decisions that may have an impact on employment, which could have long-term economic effects(Thacker et al., 2019). The employment effect may occur at various moments in time and space and may differ significantly across various economic sectors(Thacker et al., 2019).

The provision of transportation infrastructure is also an endogenous process, therefore it is possible that there is no clear causal link between transportation investment and employment(Thacker et al., 2019). Due to limited evidence in this area, the current study seeks to fill this knowledge gap using Kenyan counties as a case study to study this nexus, with an aim of increasing a frontier of knowledge. In the next section, we present a brief background of the study.

1.1.Background to the study

In any country, the economic relevance of road infrastructure is vital (Ansar, A., et al., 2016; Farhadi, 2015). A well-connected road network is essential for supporting economic growth and development by allowing for the smooth flow of goods, services, and people both inside and beyond borders (Tuluy, 2016). This connectedness not only promotes economic growth but also improves general well-being by connecting geographically disparate groups and encouraging social interactions (Luo et al., 2021).

Additionally, improved road networks contribute to increased accessibility to employment, healthcare, and education, thereby advancing civilization and economic development (Luo et al., 2021).

On the flip side, insufficient road connectivity in specific regions poses constraints on various economic activities, impeding private and foreign direct investments (Crescenzi et al., 2016). Inadequate transportation infrastructure leads to escalated costs in delivering goods to markets, adversely affecting producers who struggle to maintain competitive pricing (Nakamura, 2015). This dilemma has the potential to instigate a harmful cycle of poverty and impede economic growth, particularly in the prompt transportation of perishable goods such as horticultural products (Nakamura, 2015). To address these challenges, many African countries prioritize expanding their road networks to stimulate economic growth and enhance accessibility in underserved areas (Crescenzi, et al., 2016; Nakamura, 2015).

The link between transportation infrastructure and economic growth has long been debated. Traditional theories underscore transportation as a pivotal factor influencing business and residential locations, emphasizing the role of robust infrastructure in enhancing a region's competitiveness (Weber, 1928; Dodgson, 1974). Other perspectives, such as those presented by De Melo & Tsikata (2015) and Drysdale & Garnaut (2022), stress the necessity for improved transportation connections to eliminate bottlenecks in production, commerce, and economic integration. From a macroeconomic standpoint, rooted in endogenous growth theory, transportation infrastructure is believed to impact economic growth either directly as a factor input or indirectly by fostering technological innovation (Meade, 1952).

Recent research on urban transportation improvements highlights the potential for reduced travel times and costs to fortify agglomeration benefits, fostering productivity growth (Vickerman, 2017). Moreover, the perceived image of regions with robust transportation infrastructure is considered crucial for businesses and regions, translating into broader economic benefits beyond direct user advantages (Tveter, 2020; Rokicki & Stpniak, 2018).

However, investments in transportation infrastructure do not guarantee universal success in promoting growth and development. Factors such as regional development conditions, agglomeration, and sectoral composition can influence the impact of infrastructure supply (Hansen et al., 2015). The direction of causality in this relationship may not always be straightforward, and concerns arise regarding diminishing returns from continuous infrastructure improvements in mature economies (Straszheim, 1972; Reitveld, 1994).

There is a pressing need for careful consideration of potential consequences, along with an acknowledgment of the evolving nature of transportation costs' relevance to enterprises and sectors. The assertion that transportation costs are becoming less relevant may overlook potential expenses associated with transporting people (Willis et al., 2020). While the impact of generalized costs remains unclear, transportation costs can continue to be a significant barrier to spatial commerce and interactions (Willis et al., 2020). Furthermore, improvements in transportation may result in both centralization and dispersion of economic activity, depending on factors such as initial transportation costs, lowered expenses, and agglomeration economics (Gaspard & Mueller, 2021; Cheng et al., 2015).

Understanding the complex relationship between transportation infrastructure and economic outcomes requires careful consideration of factors like trade barriers, export-based industries, and potential job displacement due to substitution effects (Rietveld, 1986; Rietveld and Bruinsma, 1998; Button, 1998). The net employment effect of transportation infrastructure investments is uncertain, necessitating careful analysis to discern the overall impact on employment growth and potential job losses in specific industries.

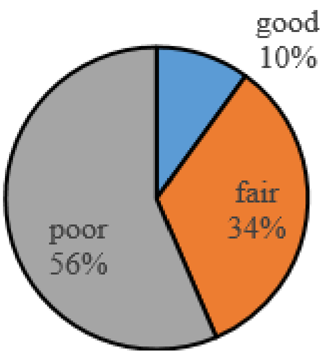
In conclusion, while transportation infrastructure undoubtedly plays a crucial role in economic development, its impact is nuanced and influenced by various contextual factors. Comprehensive analyses considering both direct and indirect effects are essential for formulating effective policies and ensuring sustainable economic growth.

1.1.1. Review of Road Network in Kenya

In this study, road transport is defined as the system facilitating the movement of people, goods, and crucial information within the economy (Guerrero-Ibanez et al., 2015; Huang et al., 2018). It operates as a network enabling the distribution of products from one region to all parts of the country (Meersman, H., & Nazemzadeh, M., 2017; Mfenjou et al., 2018). Based on this criterion, Kenya still necessitates essential road infrastructure, given that a substantial portion of the country's roads remains undeveloped and unclassified.

The Kenyan road network is broadly categorized into two groups: classified and unclassified roads. Over 50% of all Kenyan roads fall into the poor category, while fair and good roads constitute 34% and 10%, respectively. Out of the country's roads, 39% are classified, with 6% identified as international trunk highways (or class A), 4% as national trunk roads (or class B), and 43% as minor roads (or class E) (KNBS, 2018).

Figure 1: Conditions of roads in Kenya

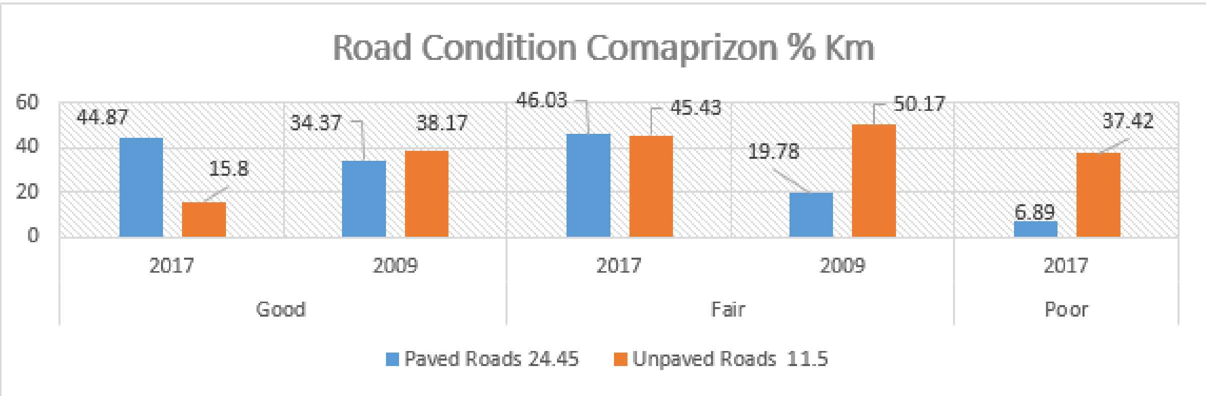


Source: KNBS (2018)

Further data reveals that, in comparison to the base year of 2007, paved roads in "Good" condition exhibited a robust performance in 2017, soaring from 21.45% to 44.87%. Conversely, substandard roads experienced only a slight increase over the same period, growing by 6.87%. The data also signifies a noteworthy enhancement in the condition of unpaved roads classified as "Good," escalating from 11.50% in 2007 (the base year) to 15.80% in 2017. Concurrently, those categorized as "Poor" witnessed a decline from 50.17% in 2007 to 37.42%.

Nevertheless, Figure 2 raises a concern, illustrating a substantial portion of unpaved roads in deteriorating condition. In 2017 alone, 6.89% of paved roads and 37.42% of unpaved roads received a rating of "Poor." The visible surge in paved roads classified as "good condition" from 34.37% in 2009 to 44.84% in 2017 is evident. In contrast, the statistics disclose a significant decrease in the 'excellent condition' of dirt roads, plummeting from 38.17% in 2009 to approximately 15.8% in 2017. Similar trends are observed for roads categorized as "fair condition," with paved roads experiencing an increase from 19.78% in 2009 to 46.03% in 2017, while unpaved roads underwent a decrease from 50.17% to 45.43% during the same period.

Figure 2: Kenya's condition of road between 2009 and that of 2017



Source: Kenya Roads Board, 2018

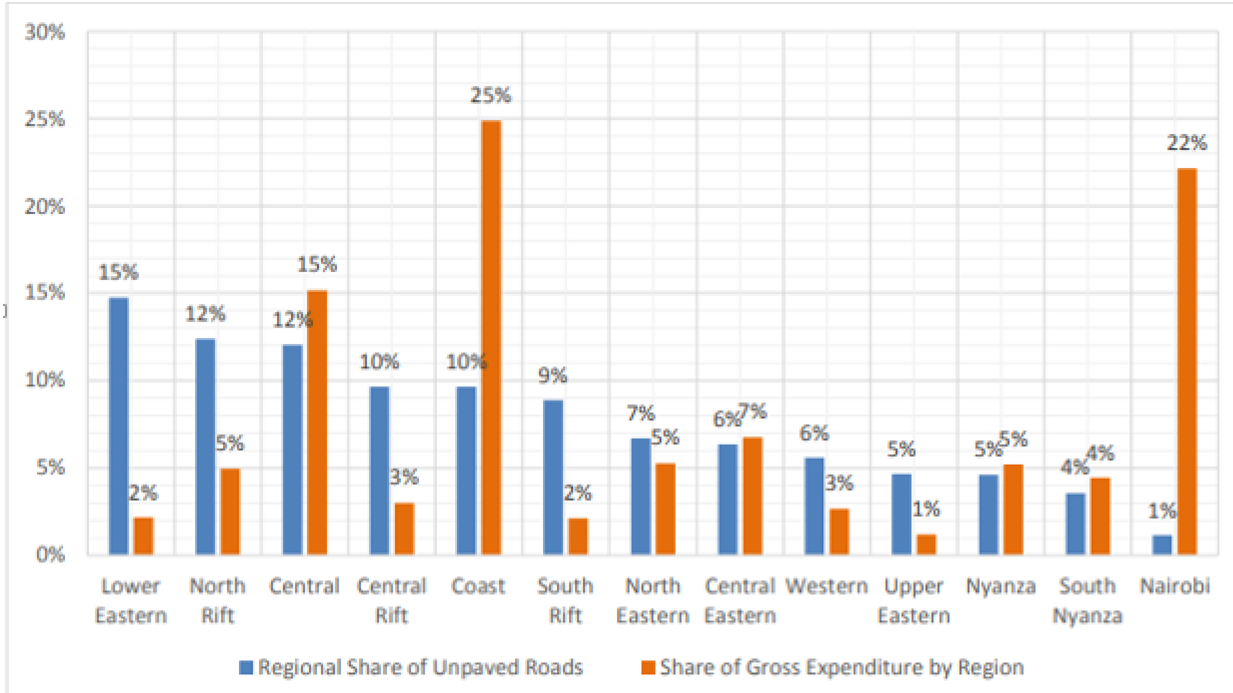
The KNBS's figures for the years 2005 to 2011 show that while spending on subsidiary roads has decreased, it has increased significantly for trunk highways. Primary roads, the majority of which are in rural farming communities, receive the least funding. Due to significant road improvements started in 2019, government spending on roads has recently continued to rise. 2020 saw a continuation of this pattern, with development spending rising by around 15.5%.

1.1.2. Link between roads and county performance in Kenya

In 2013, the county-based governance system established by the Kenyan Constitution of 2010 came into effect, leading to the creation of 47 counties, each with its own administration. Subsequently, in January 2016, a gazette notice transferred 121,456 km of highways to the C.G, while 39,995 km of national trunk roads remained under the jurisdiction of the central government. Following this devolution, CG have been implementing devolved functions and receiving funding from the Central Government, as outlined in the Fourth Schedule of the Constitution. Each county government has developed its own development strategy, with a particular emphasis on improving road transportation, recognizing the crucial link between economic success, especially in agricultural productivity, and the state of the roads (Boopen, 2006).

In 2018, the Coast region emerged as the frontrunner in both budgetary allocation and road access, closely followed by the Nairobi region at 22%, with the central region securing the third position at 15%. Noteworthy is the fact that the Upper Eastern areas of CoI (County of Isiolo) and CoM (County of Marsabit) received the lowest budgetary allocation for roads, recording a rate of 1%.

Figure 3: Regional unpaved roads in 2018



1.2.Problem statement

Various macro-level studies have endeavoured to elucidate the connection between investments in road infrastructure and overall employment. However, the evidence they present remains inconclusive and contradictory. Some studies suggest a positive and significant correlation between total employment and the stock of road infrastructure (Clark and Murphy, 1996), government spending on roads (Islam, 2003), and the accessibility of major roads (Boarnet, 1994). Despite these encouraging findings, other research (Duffy-Deno, 1998) and analyses of highway spending (Eagle and Stephanedes, 1987) show no significant relationship between the stock of roads and highway expenditures. Some scholars even argue that an increase in road capital (Pereira, 2000) or public investment in roads (Lombard et al., 1992; Dalenberg and Partridge, 1995) may lead to a decrease in the need for total employment. Understanding the conflicting information that is coming from this line of study has received less attention. Another probable explanation is that most of the prior work has typically suffered from a number of methodological flaws, in addition to the common variances in focus and approach among research. For instance, several significant factors affecting employment are frequently left out of research, and the regression models that are calculated lack a consistent theoretical foundation. Studies that only use cross-sectional data frequently do not take into consideration unobserved regional heterogeneity that might explain disparities in employment trends by location. The idea that employment is a result of transportation infrastructure is another drawback of much empirical studies. This is a bold assumption given the likelihood of a bidirectional link between employment and investments in transportation infrastructure. As was already indicated, public investment in transportation infrastructure might be directed at either region with a developing economy or, alternatively, those with failing economic performance. The endogeneity of the transportation infrastructure may result in estimate errors if these reverse causal linkages are not taken into consideration. The current study addresses these restrictions while also examining the connection in the context of a less developed country.

1.3.Research Questions

The main research question of this study seeks to explore the empirical relationship between county infrastructure development and county employment in Kenya. Specifically, the study seeks to answer the following research questions

I. What impact does county road infrastructure have on county employment among Kenyan counties?

II. What policy implication is based on the study findings?

1.4.General objectives

The main objective of this study to explore the empirical relationship between county infrastructure development and county employment in Kenya. Specifically, the study seeks to

III. To investigate the impact of county road infrastructure on employment,

IV. To recommend policy implication based on the study findings

1.5.Significant of the study

Focusing on the macro-level correlation between road infrastructure and county employment, this study seeks to scrutinize the intricate connections between county road transport investment and county economic development. To elucidate this relationship both temporally and spatially, contemporary advancements in dynamic panel and spatial econometric approaches will be employed. The research aims to make a substantial contribution to the empirical understanding of the interplay between county employment and investments in road infrastructure. Additionally, the study delves into the impact of highway capacity expansion on private sector production, providing insights into how economic development influences the economy.

1.6.Organizational structure

Following this introductory chapter, chapters two and three unfold. Chapter two delves into the theoretical and empirical literature that underpins the study, culminating in a summary of the literature. Moving to Chapter 3, we outline the approach employed to address the research topics. This chapter meticulously details the research strategy, encompassing the theoretical framework, empirical model, diagnostic tests, estimating technique, as well as the data sources and data type.

Chapter II

2.0. Introduction

2.1. Theoretical Literature Review

2.1.1 Basic Growth Theory

This theory posits that the production function, utilizing capital and labor units as inputs, can be employed to analyze economic growth. While many foundational growth models emphasize physical capital as the primary driver of growth, other significant factors, like labour unit (that proxy human capital) and technology, also have a crucial roles. Infrastructural development, often referred to as a direct input to economic growth, represents the supply side of economic growth in this fundamental growth theory. According to Boopen (2006), an expansion in the infrastructure stock is anticipated to stimulate economic growth by facilitating the flow of finished products to markets and inputs (such as labor) to manufacturing locations. Consequently, improving infrastructure development reduces production costs and enhances firm profitability, creating an attractive environment for investment and attracting both domestic and foreign investors (Shi & Sun, 2017).

The foundational growth model outlines five key relationships between road infrastructure and economic growth. Firstly, as a constituent of physical capital, road transportation contributes significantly to the production process. An expansion in the road network is anticipated to correlate with increased overall output, fostering economic growth. Secondly, road infrastructure plays a vital role in supporting various facets of production by mitigating transportation costs, addressing concerns raised by experts like Collier and Gunning (1999), who attribute Africa's economic challenges to insufficient road transport networks. Thirdly, road infrastructure serves as a catalyst for factor accumulation. A poorly developed road system may hinder the advancement of human capital, thereby slowing down overall output. Conversely, a well-connected road network facilitates mobility for employment and education, contributing to the accumulation of this crucial production element.

Fourthly, enhanced road infrastructure has the potential to stimulate demand aggregation. Road construction or maintenance activities contribute to GDP by boosting demand for goods and services, aligning with Keynesian principles of bolstering aggregate demand during economic downturns—often referred to as the "demand side of road infrastructure." Finally, the construction of roads can be seen as an instrument of industrial strategy. For example, building a road in a rural area as part of a decentralization policy has the potential to attract private investment and enhance productivity in the region.

2.1.2 Solow Growth Model

According to this theory, economic growth is driven by capital accumulation. The Solow growth model, $Y_t = AK_t^{\alpha} N_t^{1-\alpha}$, Where Y_t is total output, A denotes capital efficiency (or technical development), K denotes stock of current capital, and N denotes population increase, which stands in for labor. Total factor effectiveness appears in the Solow-Swan model when the impact of capital accumulation on economic growth is taken into consideration. An improvement in technical advancement or in infrastructure development, such as improved road connection, can be translated as an increase in the factor of production (Solow, 1956). Fundamentally, the provision of infrastructure might have an impact on productivity (which in this case is A in the equation above), which in turn could result in long-term employment changes.

Less labor is needed to generate a given level of output necessary because public infrastructure improvements may increase company productivity. As a result, if demand for a business's output stays the same, the need for personnel utilized in firm production may decrease. Public capital is used in this situation to replace labor. Public capital and labor, however, could be complementary. This is due to the possibility that increased productivity brought on by infrastructure improvements may lead to more private investment and employment. As a result, it is unclear what impact increased productivity brought on by infrastructure improvements would have overall on the need for labor.

2.1.3 Hansen's (1965a) hypothesis

Hansen (1965a) carried out an important research that dives into the theoretical debate on the possible efficacy of public infrastructure provision and its consequences for diverse locations. The form of public capital investment and the developmental condition of the region where the investment takes place, according to Hansen's concept, are major factors of prospective economic development. He contended that providing social overhead capital (SOC), which includes infrastructure such as schools, hospitals, and parks, will disproportionately assist less developed regions. In contrast, the provision of economic overhead capital (EOC), which includes infrastructure such as roads, bridges, water supply, and electricity supply, may have a greater influence on economic growth in intermediate regions than in both congested and less developed regions.

According to Hansen, investment in both forms of public capital may not be economically viable in crowded locations with particularly large concentrations of people, industrial and commercial operations, and public infrastructure. While such expenditures may boost economic activity, the marginal social advantages from increasing agglomeration economies may be offset by marginal social costs, such as greater congestion caused by increased use of public infrastructure. Instead, Hansen suggests that suitable government policies be used to prevent the rise of crowded areas and foster economic expansion in alternative places.

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In a nutshell, his hypothesis suggests that increased investment in road infrastructure leads to a boost in employment opportunities. The idea revolves around the notion that construction and maintenance of roads create jobs, both directly and indirectly.

In the direct sense, you've got the workers on the construction sites—builders, engineers, laborers—contributing to the immediate employment impact. But Hansen didn't stop there; he also considered the ripple effect. Improved roads can stimulate economic activities by enhancing transportation efficiency. This, in turn, can foster growth in various sectors, leading to more job opportunities indirectly tied to the initial road investment.

The hypothesis essentially argues that the road network serves as a catalyst for economic development, generating a positive feedback loop where increased employment results from both the initial construction endeavors and the subsequent economic growth facilitated by improved transportation infrastructure

2.2. Empirical Literature review

Lei et al. (2019) highlight the significance of transport investment in the context of women's labor market activities, emphasizing that women, more so than men, often face challenges such as limited access to motorized transport options or extended travel times to paid work. Examining the implications of transport investment on women's employment outcomes in India necessitates a careful consideration of these factors. Their analysis shows that better road conditions and access to transportation were linked to women's livelihood diversification from agriculture into nonagricultural industries, increasing the likelihood that they would find off-farm work.

Zografos and Stephanedes (1992) conducted a study in 87 Minnesota counties in the United States to assess the impact of road infrastructure investment on employment outcomes. Their findings indicated that counties with significant highway corridors experienced a boost in both overall and sector-specific employment with increased government spending on highways. In contrast, counties lacking such corridors witnessed a decline in employment despite higher highway spending. This aligns with Stephanedes's (1990) earlier research, emphasizing the importance of major thoroughfares in shaping regional economic hubs.

Crane and Leatham (1993) emphasized the importance of highway finance across different areas in their research for Texas. According to their time-series analysis, highway building and maintenance expenses had a greater impact on employment in urban counties. In a comparable dataset for all 87 Minnesota counties, Eagle and Stephanedes (1987) and Stephanedes (1990) found no clear evidence of a statewide influence. However, they discovered that highway upgrades had a favorable impact on employment in some types of counties, notably regional center counties that function as economic centers.

Stephanedes' (1990) study, employing more specific criteria for county classification, revealed that increased highway spending positively influenced employment levels in regional hubs and counties linked to metropolitan centers. Conversely, it had a negative impact on employment in counties near those benefiting from highway upgrades. This led to the conclusion that highway investments caused a geographical redistribution of economic activity, favoring wealthier locations at the expense of underdeveloped regions.

In a systematic analysis by Kasraian et al. (2016), evaluating rail and road infrastructure on four continents (the United States, Europe, and East Asia), the long-term effects on land-use change were examined. The study revealed that rail investments were positively associated with increased population density, while road investments were linked to improved local job outcomes. Road infrastructure, compared to rail infrastructure, had a more substantial impact on changes in land use, population density, and employment density.

2.3. Overview of Literature

The theoretical and empirical studies we've reviewed suggest that the influence of public infrastructure investments on a region's economic development may vary based on the unique characteristics of the recipient regions. This variability stems from the understanding that infrastructure investments, while crucial, may not independently ignite economic activity. It is a necessary but not sufficient condition for growth and development (Fox and Murray, 1993) In essence, infrastructure development cannot ensure growth on its own; yet, it does provide a necessary condition for regional economic development. Consequently, the impact of infrastructure supply on economic growth relies on the presence of other essential conditions and the region's capacity to capitalize on the development opportunities facilitated by improved infrastructure. It is imperative to grasp this connection in the context of regional development in Kenya.

Chapter III: Methodology

3.0.Introduction

3.1.Theoretical framework

The theoretical framework of the present study is rooted in conventional economic theory, aiming to establish a reduced-form model for employment. This model takes into consideration the influence of road infrastructure investments on both labor supply and demand. Equations 1, 2, and 3 presented below articulate three equilibrium conditions essential for understanding the labor market equilibrium within the context of our straightforward structural model

The labour demand function is assumed to be a function of w (which is the wage rate for labour) and D (which is other determinates of labour demand). Notably, labour demand is a decreasing function of wages.

$$L^{demand} = f(w, D); \qquad \frac{d(L^{demand})}{dw} < 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{Equation 1}$$

The labour supply function is assumed to be a function of w (which is the wage rate for labour) and S (which is other determinates of labour supply). The labour supply is an increasing function of wage.

$$L^{supply} = f(w, S); \qquad \frac{d(L^{supply})}{dw} > 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{Equation 2}$$

And at equilibrium, labour demand is equal to labour supply

$$L^{demand} = L^{supply} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{Equation 3}$$

In deriving the aggregate labour demand model, let’s assume that the production possibilities of a given county in Kenya is its summative production function. Thus we can assume that each county uses capital inputs and labour inputs to produces output using. The C-D production of each county’s private or public sector can be given as .

$$Q = AK^{\propto}L^{1-\propto} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{Equation 4}$$

Where Q = is the combined output

K = is the capital inputs

A = a technical efficiency parameter in a Hicks-neutral form

L = labour input,

and $\propto$ and $1-\propto$ are parameters.

From the duality problem in producer theory, we can assume that firms operating in a competitive market will seek to minimize the private production costs (C):

$$C = wL + rK \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 5}$$

In the realm where 'r' orchestrates the expense of leasing private capital services and 'w' takes center stage as the wage rate, the magic of conditional input demand functions unfolds. These functions emerge by dancing to the rhythm of minimizing the cost (as per equation 5) while keeping the production (from equation 4) in harmony. Now, cue the Lagrange technique—a choreography that introduces the Lagrangian maestro, L_g . This artistic creation is a fusion of the goal function, the Lagrange multiplier (μ), and the decree that our input duo must conjure up the sought-after output level.

$$L_g = wL + rK + \mu(Q - AK^{\alpha}L^{1-\alpha}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 6}$$

Taking the first order condition (FOC) for minimization of cost of equation 6 with respect to L, K and μ

$$\frac{dL_g}{dL} = w - (1-\propto)K^{\propto}L^{-\propto} = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 7}$$

$\frac{dL_g}{dK} = r - (\propto)K^{\propto-1}L^{1-\propto} =$

$0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{Equation 8}$

And

$\frac{dL_g}{dK} = Q - AK^{\propto}L^{1-\propto} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{Equation 9}$

Solving equation 7,8 and 9 yield a labour demand equation given as

$L^{demand} = \frac{1}{Q^{\propto+(1-\propto)}}\frac{1}{A^{\propto+(1-\propto)}}(\frac{w}{r}.\frac{\propto}{(1-\propto)})^{\overline{\propto+(1-\propto)}^{\propto}} \ldots\ldots\ldots\ldots\ldots\ldots \textit{Equation 10}$

Taking the natural log of equation 10 we have

$lnL^{demand} = \propto \gamma[ln(1-\propto) - ln \propto] - \propto \gamma lnw + \propto \gamma lnr + \gamma lnQ - lnA \ldots\ldots \textit{Equation 11}$

Where $\gamma = \frac{1}{\alpha+(1-\alpha)}$

Investments in transportation infrastructure may be viewed as advancements in production technology from the perspective of the Hicks-neutral production function shifter (A), which raises the total factor productivity of businesses. According to research by Graham (2000), productivity heterogenity at regional level may also be influenced by variations in a number of site-specific factors, such as the composition of the industry, government investments in local public services, the characteristics of the labor force, and agglomeration economies and diseconomies. As a result, the production function shifter includes the impact of local features (T) and road infrastructure (H) on productivity:

$A = H^{\emptyset} \prod_i T_i^{Z_i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{Equation 12}$

Where i refers to the number of proxy variables. Inserting the new value of A from equation 11 into equation 12 yields the aggregate demand function in equation 13

$lnL^{demand} = \propto \gamma[ln(1-\propto) - ln \propto] - \propto \gamma lnw + \propto \gamma lnr + \gamma lnQ - \emptyset\gamma lnH + \sum_i \varphi_i \gamma lnT_i .. \textit{Equation 13}$

Equation 13 state that, the aggregate demand for labour at the county level depends on the wage rate, rental rate, level of output, availability of road infrastructure and other key determinants of productivity.

3.2. Empirical framework

Our empirical model is extended from the theoretical model in the previous sub-section. The static panel model states that equilibrium employment E^* is a function of road infrastructure investment (H) and other control variables (Z).

$$lnE_{it}^* = \alpha + \beta lnH_{it} + \gamma^* lnZ_{it} + \mu_i + \tau_i + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots Equation\ 14$$

Where ε_{it} an i.i.d. error is term, μ_i and τ_i are the time-invariant region-specific component and county-invariant time-specific component.

3.2.Data type, Data sources and topology

Table 1: Variable descriptions and data sources

Key study Variable	**Their description and measurements**	**Expected sign**	**Variable data source(s)**
Dependent variable			
E_{it}	This is the waged persons per county. Measured as the number of waged persons per total population of a given county.	Dependent variable	Various County Reports
Independent variable			
H_{it}	This is the total financial year expenditure on road infrastructure per county.	Positive	County, Ministry of Transport and Infrastructure Offices/KNBS
Control variables Z_{it}			

county output	This is the gross county product of ith county at period t. it shall be measured as GDP per county. Its available in statistical abstracts in KNBS data base	positive	Various County Reports, KNBS
Human service expenditure	This is the county per capita real publi expenditures for human Services such a health, mental health, legal aid expenditure subsidies paid to hospitals social service administration, an assistance programs	Positive	Various County Reports
Education expenditure	This is the county Per capita real public expenditures on capital outlay and current operations for public schools (Early Childhood Development) and community colleges (TVET)	Positive	Various County Reports
County average wage	This is the average wage for county workers in Kenyan shillings	Positive	Various County Reports

We shall use a panel data for the period of 2015–2022, which includes some selected county governments in Kenya, the study will employ secondary data obtained from various county reports. Data will be gathered from the KNBS. We select this time frame because it is the one during which data on road infrastructure spending was broken down into county level and was easily accessible.

3.3.Diagnostic tests and estimation strategy.

3.4.2 Test for Auto-correlation

We shall utilize the Breusch-Pagan test to unveil the presence of autocorrelation. This test sets out to explore whether a correlation between the previous and current error terms is in the spotlight. If the probability values from the Breusch-Pagan test significantly greater than the critical threshold of 0.05 the null hypothesis shall rejected, otherwise we shall fail to reject.

3.5. Post- estimation Tests.

3.5.1 Heteroscedasticity Test

When the variance of errors varies among the independent variables, heteroscedasticity is present. The simple fact that they exist renders statistical significance tests worthless since they rely on the presumption of uncorrelated and consistent modelling errors. In order to prove the existence of heteroscedasticity, the Breusch-Pagan test shall be used (Khaled, Lin, Han, Zhao, & Hao, 2019). The homoscedasticity assumption is upheld if the p-value is greater than 0.05. The data are transformed and weighted least square regression is used if the homoscedasticity condition is violated.

3.5.3. Hausman Test for Fixed and Random Effect

To determine the model that best fits our dataset, we'll conduct a test. This examination scrutinizes the null hypothesis, suggesting that alpha i bears no connection to the explanatory factors, against the alternative hypothesis, proposing a relationship between alpha i and the explanatory variables.

3.5.4. Estimation techniques

Opting for a panel data estimate approach over cross-sectional and time-series datasets offers numerous advantages. According to Baltagi (2008), the absence of consideration for unobserved variability in both time-series and cross-sectional studies increases the likelihood of biased results. Panel data, in contrast, accommodates county- and time-invariant factors, addressing this limitation (Baltagi, 2008).

Before delving into model estimation, a poolability test will be executed to assess the constancy of alpha and beta using the F-statistic. The decision-making process involves determining whether the pooled panel is the most fitting model. If the null hypothesis cannot be rejected (indicated by a high p-value), the pooled panel is deemed suitable. Conversely, a low p-value prompts the rejection of H0, signalling the need to choose between the fixed effect model and the random effect model. The Hausman test (1978) becomes the decisive tool in this selection process, examining whether fixed effect (FE) or random effect (RE) is more apt for the dataset.

The hypothesis tested in the Hausman test pertains to the correlation between unique errors and regressors (Greene, 2008). The study's foundational decision hinges on the obtained p-value. If the p-value exceeds the 5% significance threshold, indicating no correlation, the random effects technique is favored for capturing individual-level effects. Conversely, if the null hypothesis cannot be rejected, the fixed effect model is preferable.

Distinguishing between Random Effects (RE) and Fixed Effects (FE) involves understanding their assumptions. RE assumes omitted effects as random variables, while FE assumes consistent omitted effects unique to cross-sectional units over time. Chamberlain (1984) cautions the need to verify the validity of these limits before adopting the fixed effects model, as it imposes testable restrictions on the parameters of the reduced form model. On the other hand, Mundlak (1978) notes that the random effects model assumes exogeneity and randomness of all regressors. The discussion of results will ensue after specifying the random effects model (Hausman, 1978).

3.5.5. Addressing endogeneity problem

We suspect that our main variable of interest "road infrastructure expenditure" may be endogenous rather than exogenous as required for linear regression models. The intricacy arises from the endogeneity of transport infrastructure provision, leading to an ambiguous causal relationship between transport investment and employment. To tackle this challenge, we will employ the "Two-Stage Residual Inclusion Model," commonly known as the "control function" approach, for testing and resolving endogeneity issues. This shall be done in two stages. In the first stage, we shall estimate road infrastructure investment (H) against the instrumental variables (in this case the other control variables, Z).

$$lnH_{it} = \gamma^{*} lnZ_{it} + \mu_i + \tau_i + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 15}$$

From equation 15, we shall obtain the estimated values of road infrastructure investment ($\hat{H}$) and error terms $\bar{e}$. In stage two, we shall regress equation 14 inclusive of $\hat{H}$ and $\bar{e}$ as shown in equation 16

$$lnE_{it}^{*} = \alpha + \beta ln\hat{H}_{it} + \delta\bar{e} + \gamma^{*}lnZ_{it} + \mu_{i} + \tau_{i} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 16}$$

In this stage, the interest shall be in the significance of δ. If $\delta$is statistically significant, then we shall conclude that road infrastructure investment is endogenous and we shall estimate equation 17

$$lnE_{it}^{*} = \alpha + \beta ln\hat{H}_{it} + \gamma^{*}lnZ_{it} + \mu_{i} + \tau_{i} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 17}$$

But if $\delta$is statistically insignificant, then we shall conclude that road infrastructure investment is exogenous and we shall estimate equation 14.

CHAPTER IV

ANALYSIS AND INTEPRETATION OF RESULTS

4.1 Introduction

Our exploration of the dataset commences with a comprehensive examination of descriptive statistics, providing a foundational understanding of the key variables. Following this, we present the results of various diagnostic tests, including the correlation matrix, multicollinearity test, and heteroscedasticity test, offering insights into the data's characteristics. Following this, post-estimation tests, to select the appropriate model is done. The thorough examination of these tests is instrumental in pinpointing the most fitting model, establishing a solid foundation for a robust and trustworthy analysis of the research data.

4.2 Descriptive statistics

Descriptive statistics for variables of interest is done and outlined in Table 2. The summary is conducted on a county-specific basis, with 12.77% of the sample counties (six out of the forty-seven) being included in the analysis. The selection of counties for the sample predominantly hinges on the availability of comprehensive data concerning the variables of interest. The variable "County average wage" was dropped from the model since it was either missing in most counties or when available, it was constant throughout the study period.

The findings presented in Table 2 indicate significant variation in employment (proxied by the percentage of waged individuals per county population) across the sampled counties. Bomet County emerged with the highest proportion of waged individuals, accounting for approximately 39.60% of its population. Following closely was Baringo County, where around 26.59% of the population was engaged in waged employment. In contrast, the remaining four counties exhibited notably lower rates, with less than 1% of their populations being employed. Plausible reasons for this heterogeneity of waged persons across counties include (i) Counties in Kenya differ in their economic structure. Thus, they may differ in their economic structures, with some being more industrialized or having a stronger service sector. Economic diversity can influence the availability and distribution of waged employment (ii) we also think that counties with higher levels of industrialization, like Bomet County are likely to have more waged employment opportunities, especially in manufacturing and related sectors (iii) Equally, counties with a predominantly agrarian economy, such as Bungoma County may have a lower percentage of waged employment, as many individuals in these regions may be engaged in subsistence farming or informal agricultural activities. (iv) Urbanized counties tend to offer more diverse employment opportunities, including waged positions in various sectors. Rural counties may experience lower rates due to limited non-agricultural employment options. (v) Counties that attract more investments and have well-developed infrastructure may experience higher economic activities, leading to increased waged employment opportunities. (vi) Disparities in educational attainment across counties can impact the availability of skilled jobs and, consequently, the proportion of waged employment. (vii) Counties with rich natural resources may have specific industries that drive waged employment, such as mining or forestry.

The average annual total road expenditure (which was a proxy of infrastructural investment) was found to be KES 479.6 million for Bungoma County, KES 322.3 million for Busia County, KES 234.1 million for Baringo County, KES 310.7 million for Bomet County, KES 163.0 million for Elgeyo Marakwet County and KES 243.0 million for Embu County. The average annual road expenditure plays a key role in predicting some economic indicators such as county employment such as (i) increased road expenditure often leads to infrastructure development projects, such as road construction and maintenance. These projects generate employment opportunities directly in the construction sector, including jobs for laborers, engineers, and other related professionals. (ii) Improved roads can enhance transportation efficiency, facilitating the movement of goods and services. Local businesses, such as those involved in logistics, transportation, and trade, may experience growth, leading to increased demand for labor (iii) Enhanced connectivity through road development can benefit local industries, attracting investments and fostering expansion. Growing industries tend to create more jobs across various skill levels within the county. (iv) Improved road infrastructure makes it easier for individuals to commute to employment centers, increasing accessibility to job opportunities. This can lead to a more efficient labor market and a reduction in unemployment rates and (v) Counties with well-developed road networks are often more attractive to investors. Increased investments can result in the establishment of new businesses and industries, contributing to job creation

The result further shows that counties were highly heterogeneous on the gross county product. Bungoma and Busia Counties had the highest gross county product, each averagely at KES 1.69 billion followed by Bomet and Embu County at KES 1.18 billion and KES 1.28 billon respectively. Baringo and Elgeyo Marakwet counties had the least gross county product each as KES 6.16 billion and KES 7.65 billion respectively. Gross County Product (GCP) is primarily an economic indicator measuring the total value of goods and services produced within a county and it can indirectly reflect trends in employment within that county. For example (i) A growing GCP often indicates increased economic activity within a county, which can lead to higher employment rates. As businesses expand and produce more goods or offer additional services, they may hire more workers to meet the demand. (ii) Examining the composition of GCP by economic sectors provides insights into the areas contributing most to the county's economic output. Sectors with higher GCP contributions likely have a greater impact on employment within the county. (iii) GCP growth in labour-intensive industries, such as manufacturing or services, can signify increased employment opportunities. For example, a rise in manufacturing GCP might correlate with more jobs in factories. (iv) Increased GCP may attract investments and new businesses to the county, potentially resulting in job creation. Investors often seek regions with a growing economic output as it signifies a favourable business environment. (v) GCP growth has a multiplier effect, impacting various sectors of the economy. For every dollar spent within the county, there may be additional economic activity and job creation throughout the supply chain.

Further, the average human service expenditure was fund to vary across the counties with Bungoma County having the highest annual average (approximately KES 3692.13 million) followed by Busia and Baringo at KES 2484.13 million each. Bomet, Elgeyo Marakwet and Embu County had KES 2130million, KES 2007.38 million and KES 2607.66 million respectively. The average human service expenditure in a county plays a significant role in influencing county employment such as (i) Increased human service expenditure often leads to the expansion of public sector services. Hiring additional staff for social services, healthcare, education, and other related programs contributes to public sector employment growth. (ii) Human service expenditure, particularly in healthcare services, can result in the creation of jobs in hospitals, clinics, and related healthcare facilities. Hiring healthcare professionals, support staff, and administrative personnel contributes to employment growth (iii) Expenditure on education services, including schools and training programs, can lead to the hiring of teachers, administrative staff, and support personnel. Investments in education contribute to job creation in the education sector. (iv) Increased spending on human services may lead to the hiring of social workers, counsellors, and other professionals involved in providing support to individuals and families. Expanding social service programs can result in additional employment opportunities in these fields (v) Expanding human service programs may require the construction or renovation of facilities. Jobs are created in construction, maintenance, and related services, contributing to employment growth.

Table 2: Descriptive Statistics

Variable		Bungoma	Busia	Baringo	Bomet	Elgeyo Marakwet	Embu
E_{it} (Percentage waged person per county population)	Obs	8	8	8	8	8	8
	Mean	.0007819	.006890	.265933	.395952	.0070082	.009318
	Std dev	.0002178	.000028	.006283	.158303	.0001344	.000397
	Min	.0006034	.006861	.256956	.202858	.0068195	.008750
	Max	.0010542	.006944	.274911	.007224	.0072236	.009885

Road expenditure	Obs	8	8	8	8	8	8
	Mean	4796.375	3223	2340.5	3106.75	1629.875	2429.15
	Std dev	1272.917	955.704	541.011	657.689	490.256	1000.19
	Min	2333	1229	1391	2518	652	828
	Max	6475	6475	3082	4260	2041	3614
Gross County Product	Obs	8	8	8	8	8	8
	Mean	1.69×10^9	1.69×10^9	6.16×10^8	1.18×10^9	7.65×10^8	1.28×10^9
	Std dev	1.84×10^8	1.84×10^8	6.91×10^7	2.06×10^8	2.18×10^8	1.09×10^9
	Min	1.44×10^9	1.44×10^9	5.19×10^8	8.99×10^8	5.33×10^8	1.15×10^9
	Max	1.98×10^9	1.98×10^9	7.30×10^8	1.46×10^9	1.12×10^9	1.48×10^9
Human service expenditure	Obs	8	8	8	8	8	8
	Mean	3692.13	2484.75	2478.13	2130	2007.375	2607.66
	Std dev	1198.528	662.128	705.06	577.466	524.9748	431.984
	Min	1751	1244	1420	971	1062	1918
	Max	4918	3331	3242	2637	2557	3119
Education expenditure	Obs	8	8	8	8	8	8
	Mean	2564.25	1547.13	1205	1349.63	645.75	1018.25
	Std dev	518.7162	479.815	161.079	567.387	187.1911	246.296
	Min	1771	917	944	725	260	680
	Max	3256	2011	1386	2198	798	1433

Source: Author's computation

4.3 Diagnostic tests

4.3.1 Correlation Analysis

Correlation analysis was guided by two main objectives. Firstly, we aimed to uncover the patterns within the variables of interest, examining whether they exhibited positive or negative correlations. Secondly, we sought to assess the feasibility of conducting a linear regression analysis for our study.

In the exploration of patterns, our focus was on discerning the nature and strength of relationships between variables. Particularly, we aimed to identify whether the variables demonstrated positive or negative correlations. Simultaneously, in the diagnostic check, theoretical considerations suggested that if variables exhibit high correlations, the reliability of linear regression estimates may be compromised.

Upon examination of the correlation matrix presented in Table 3, a noteworthy observation emerged. All variables of interest demonstrated low correlations, each being less than 50%. This indicates that linear regression estimates can be deemed reliable in our analysis. Furthermore, the findings indicate that all regressors are negatively correlated with County employment, providing valuable insights into the directional relationship between these variables.

Table 3: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)
(1) E_it	1.000				
(2) Road expenditure	-0.1301	1.0000			
(3) Gross county product	-0.4137	0.7081	1.0000		
(4) Human expenditure	-0.2801	0.7489	0.5806	1.0000	
(5) Education expenditure	-0.1906	0.8902	0.7080	0.7745	1.0000

4.3.2 Multicollinearity test

Collinearity, the presence of a linear association among two or more independent (explanatory) variables, poses a challenge by inflating the variance of parameter estimates. This inflation can potentially result in inaccuracies in the magnitude and signs of coefficient estimates, leading to erroneous conclusions. To detect and mitigate collinearity, variance inflation factors (VIFs) serve as a diagnostic measure. If collinearity is identified, one approach is to eliminate one of the correlated variables (Gujarati, 2003). Upon scrutinizing the results in Table 4, all the VIF were below the threshold of 10. This observation indicates that multicollinearity did not pose a significant issue in our dataset. Consequently, the reliability of our parameter estimates remains intact, and the potential distortions introduced by collinearity are deemed negligible.

Table 4: Multicollinearity Test result

	VIF	1/VIF
Road expenditure	5.32	0.187996
Gross county product	2.13	0.469263
Human expenditure	2.61	0.382893

Education expenditure	5.80	0.172445
Mean VIF	3.97	

4.3.3 Heteroscedasticity test

Breusch-Pagan-Godfrey test was used to test presence of heteroscedasticity and the result presented in Table 5, the P-value = 0.0282 is small enough to reject the null hypothesis of homoscedasticity.

Table 5: Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

```
Breusch-Pagan / Cook-Weisberg test for heteroscedasticity
        Ho: Constant variance
        Variables: fitted values of E_it
        chi2(1)      =    4.82
        Prob > chi2  =    0.0282
```

4.3.4 Poolability test

From Table 6, the probability of 0.000 is sufficiently small to reject the null hypothesis, leading us to the conclusion that either the fixed effect model or the random effect model could be fitting for our dataset.

Table 6: Used Chow's Poolability test

```
F test that all u_i=0: F(5, 38) = 55.44                    Prob > F = 0.0000
```

4.3.5 Hausman Test for Fixed and Random Effect

The objective of this test was to discern the most fitting model for our dataset, specifically between the random effect and fixed effect models. The outcome from Table 7, with a probability of 0.7201, indicates that we fail to reject the null hypothesis, leading us to the conclusion that the Random effect model is the appropriate choice for our dataset.

Table 7: Hausman (1978) specification test

	Coef.
Chi-square test value	2.09
P-value	0.7201

4.4 Random Effect Regression Results

Table 8 presents the outcomes derived from a Random effect model, deemed suitable for our dataset after failing to rejecting the null hypothesis Random effect being the appropriate model.

Result from Table 8 reveals that infrastructural investment as proxied by total expenditure on road was found to be insignificant in influencing county employment in all the three models (Fixed effect, which was our appropriate model and the robustness check using random effect and OLS). Plausibly, road infrastructure projects may not have a direct impact on job creation or in the counties sampled, there could have been small-scale projects that may not generate enough economic activity or employment opportunities to be a significant indicator. Another possible reason for our observation could be road infrastructure projects often have a lag in terms of generating employment. If the impact is expected in the long term, it may not be immediately reflected in short-term employment indicators. The duration of our study was quite small. Equally, road infrastructure projects may require highly specialized skills, limiting the pool of available workers. This specialization could have resulted in fewer employment opportunities for the broader workforce. Lastly, road infrastructure projects may involve outsourcing or contracting, meaning that employment opportunities are not directly provided by the county as observed in a case where some contractors or firms may bring in their own workforce.

The county employment outcome was found to be influenced by educational expenditure. For instance, holding all other factors constant, additional shilling funding to education expenditure reduces county government employment by about 12.41%. This was against our priori prediction of the nexus between education expenditure and county employment outcome. Plausible reasons for this observation could be due (i) Most counties in Kenya operating within limited budgets, and an increase in education expenditure might lead to trade-offs in other areas. For example, if the additional funds are sourced from other county government programs or services, employment in those sectors could be adversely affected. (ii) Equally, to fund increased pre-primary education expenditure, counties might resort to higher taxes or fees on available businesses. Elevated business costs can lead to reduced profitability, potentially resulting in job cuts or a slowdown in hiring. (iii) A substantial increase in education spending may lead to reduced funding for infrastructure projects or incentives for the private sector. The private sector is a significant driver of employment, and a shift in funding priorities away from it could have negative consequences. (iv) Investments in education often take time to yield economic returns as students complete their education and enter the workforce. In the short term, (like in the case of Kenyan counties that are barely ten years old) the increased expenditure may not immediately translate into a boost in employment. (v) If the education system does not align with the skills demanded by the local labor market, an increase in education spending may not result in a corresponding increase in employment. Employers may face challenges finding qualified workers, leading to unfilled job positions. (vi) In the face of increased education spending, other government programs unrelated to education may experience budget cuts. Reductions in services in areas such as healthcare, social services, or public works could impact employment in those sectors.

4.4.1 Impact of road infrastructure on county employment outcomes

Table 8: Fixed -effects regression result

VARIABLES	Rand effect model	P-value	Fixed effect model
Ln_ Road expenditure	.0473806 (.0391928)	0.227	.0444547 (.0390687)
Ln_Gross county product	-.0683051 (.0860196)	0.427	-.055279 (.0939431)
Ln_Human expenditure	.0249366 (.050795)	0.623	. .0289088 (.0526189)
Ln_Education expenditure	-.1241339** (.0475857)	0.009	-.1327966** (.047836)
Constant	1.852104 (1.522792)	0.224	1.634445 (1.664085)
Observation	48		48

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter encapsulates the summary and conclusions drawn from the pivotal discoveries in our study. Following this overview, we delve into potential policy implications for the primary beneficiaries of these findings. To round off, we propose avenues for further research, acknowledging the limitations inherent in our study.

5.2 Summary of finding

Motivated by the recognition that understanding the influence of road infrastructure on employment is pivotal for assessing a county's overall economic well-being, initiatives involving the construction and upkeep of roads have the potential to yield a substantial number of job opportunities. The enhancement of road infrastructure not only improves transportation efficiency and accessibility but also contributes to the general quality of life and desirability of a region. This study was undertaken to empirically explore the relationship between county infrastructure investment and County employment in Kenya. Specifically, the research aimed to scrutinize the impact of county road infrastructure on employment and to propose policy implications based on the findings. To achieve these objectives, an eight-year panel data set spanning from 2015 to 2022 was utilized, focusing on a representative 12.77% sample of counties (six out of the forty-seven) selected based on the availability of comprehensive data on the variables of interest. The analysis employed a panel data technique, specifically Random Effect, with robustness checks conducted using Fixed Effect method. Appropriate pre- and post-estimation tests were also carried out to ensure the reliability and validity of the study's findings.

The finds reveals that our main variable of interest (infrastructural investment as proxied by total expenditure on road) was found to be insignificant in influencing county employment in all the three models (Fixed effect, which was our appropriate model and the robustness check using random effect and OLS). Equally, we don't find enough evidence to support the impact of gross county product on county employment outcome. However, there is enough evidence to show that county employment outcome is significantly influenced by human service expenditure and educational expenditure. For example, holding all other factors constant, an additional shilling funding to education expenditure reduces county government employment by about 12.41%.

5.3 Conclusion

In conclusion, our study does not find any evidence linking road infrastructural investment and gross county product to county employment outcome. However, there is enough evidence to support education expenditure reducing county employment outcome respectively.

5.4 Recommendations

Given that county educational expenditure had a counterproductive impact on county employment outcomes, we recommend that Ensuring that county investments in pre-primary education contribute to increased county employment outcomes requires a strategic and comprehensive approach (i) Design and implement integrated workforce development programs that align with the needs of emerging industries and sectors within the county. Provide training and skill development opportunities that prepare individuals for employment in areas related to early childhood education, caregiving, and associated fields. (ii) Foster partnerships with local businesses to understand their workforce needs. Tailor pre-primary education programs to equip students with skills that are directly applicable to employment opportunities within the county. (iii) Encourage entrepreneurship in the field of early childhood education by supporting individuals to establish small businesses, such as daycares, preschools, and educational support services. Provide training and resources for individuals interested in starting their own pre-primary education ventures. (iv) Establish job placement and career services within the pre-primary education system to connect graduates with employment opportunities.

Develop partnerships with local employment agencies and businesses to facilitate job placements for qualified individuals and (v) Invest in professional development opportunities for educators and caregivers in pre-primary education. Enhance their skills and qualifications, making them more competitive in the job market and contributing to the overall quality of early childhood education.

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