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The Effect of Road Network on Economic Development: A Case Study on the Mekong Delta of Vietnam

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Abstract

Purpose: This study examines the impact of the road network on economic development in the Mekong Delta of Vietnam. **Research design, data and methodology:** To analyze the impact of the road network on the economic development of the Mekong Delta region of Vietnam, this study proposes a panel regression model with the sample data collected from four central provinces in Mekong Delta of Vietnam, including Can Tho, An Giang, Dong Thap, and Tien Giang **Results:** the findings reveal that expanding the road network significantly increases total household income by 30,686.38 to 31,698.57 thousand VND and household expenditures by 44,055.83 to 46,315.5 thousand VND, with minimal variation across models. Additionally, good road connectivity enhances the proportion of non-agricultural income and working time, supporting economic diversification and productivity. Besides, the empirical findings show environmental benefits from the development of road networks, which can reduce congestion, fuel consumption, and emissions, thereby improving air quality and minimizing environmental degradation. **Conclusions:** Based on empirical results, the paper argues the need for strategic investments in road quality, public transportation systems, and sustainable infrastructure development to ensure equitable and inclusive growth. Despite limitations related to short-time data and regional focus, the study offers actionable insights for policymakers to enhance infrastructure's role in sustainable development.

Keywords : Road network, Mekong Delta, Economic development, Panel data.

JEL Classification Code: R12, R15, C46

1. Introduction

It is argued that road networks represent the interconnected systems of roads facilitating the movement of people (Li et al., 2018), goods (Summers, 2016), and services (Rawat & Sharma, 1997) across geographical regions. Besides, road networks form the backbone of transportation infrastructure, thus playing a pivotal role in shaping economic landscapes (Tsiotas, 2021). Many previous studies agreed that well-developed road networks reduce transportation costs (Seitz, 1993), enhance accessibility (Magoutas et al., 2023), and accelerate the mobility of labor, resources, and capital (Fraser & Chester, 2016). Further, Ruiz and Guevara (2020) argued that road infrastructure stimulates market integration and promotes regional economic growth by connecting urban and rural

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areas. Accordingly, it is highly admitted that robust road networks are not merely a facilitator of financial activities (Hu et al., 2018) but also a catalyst for broader socio-economic transformations (i.e., poverty alleviation and social equity) (Krupowicz et al., 2017; Yang & H. Bell, 1998). Nonetheless, assessing the effect of road networks on economic development is still lacking in the relevant literature.

Until now, there are a few studies investigating the relationship between road infrastructure expansion and economic development. For instance, Wang et al. (2020) examined the impact of transportation networks on economic growth and found that proximity to transportation networks significantly increased GDP per capita. This finding is so consistent with that of Ng et al. (2017), who studied the effects of railroad expansion in colonial areas, showing railroad infrastructure development reduced trade costs and increased agricultural income. Besides, negative effects on economic growth in peripheral counties are not significantly connected to the road network (Xu et al., 2016), while positive impacts on manufacturing activity and productivity in districts along the highway are closely linked to road network expansion (Zhou et al., 2022). Furthermore, various prior studies illustrated that colonial railroads influenced the long-term economic development of some countries, such as India, Ghana, Zimbabwe, etc., thanks to persistent positive effects on urbanization and agricultural production (Muzapu et al., 2018; Owusu-Manu et al., 2019; Sharma & Vohra, 2009).

Prior studies examined whether road networks contribute to economic growth, such as by improving connectivity (Muzapu et al., 2018), reducing transportation costs (Li et al., 2018), and enhancing access to markets or services (Summers, 2016). These studies, however, may not have analyzed how the design of road networks, such as their density, connectivity, accessibility, hierarchical structure, etc., affects particular economic indicators, such as total expenditures, working hours, and the total income of households. Additionally, economic indicators of regional development are specific metrics reflecting the economic health or progress of a region. For instance, income levels, poverty rates, and business activity might vary depending on how well the road network is structured. However, these issues have not been thoroughly examined in the relevant literature.

To enrich the existing body of literature, this current paper aims to assess the effect of the road network on economic development with the case study of the Mekong Delta of Vietnam. Particularly, besides testing the relationship between the road network and economic growth by some regression models, the article explores the interconnection between road infrastructure and economic development in the Mekong Delta, specifically identifying how local citizens perceive the quality of the existing road network.

The remainder of this paper is structured as follows. Section 2 comprehensively reviews existing literature on the relationship between transportation infrastructure and economic development. Section 3 details the methodology. Section 4 presents empirical findings and discussions. And Section 5 concludes.

2. Literature Review

It is argued that the theoretical relationship between transportation infrastructure, particularly road networks, and economic development has been extensively explored. For instance, some prior studies using foundational theories posited that the development of transportation systems reduces trade costs (Banister, 2012), enabling efficient allocation of production resources (Wang et al., 2021) and fostering market integration (Maparu & Mazumder, 2017). Similarly, location theories suggest that road networks influence firm location decisions (Maparu & Mazumder, 2017), thus impacting regional economic activities (Magazzino & Mele, 2021).

Besides, using conceptual models, such as the New Economic Geography (NEG), the relevant studies have highlighted the role of transportation in agglomeration economies, where improved accessibility leads to clustering of economic activities (Zhang & Cheng, 2023), thereby increasing labor productivity significantly (Njoh, 2000). In addition, the Solow–Swan model (or the exogenous growth model) has also been adapted to incorporate transportation as a driver of total factor productivity (Hlotywa & Ndaguba, 2017), capital accumulation (Neto et al., 2018), and technological diffusion (Neto et al., 2019).

Over time, linear causality approaches have explored direct linkages between road investments and GDP growth, with a specific focus on spillover effects, such as labor market mobility (Banister, 2012; Njoh, 2000), and regional inequality reduction (Ruiz & Guevara, 2020; Xu et al., 2016). Additionally, integrating sustainability considerations into transportation economics reflects a growing recognition of environmental constraints. Recently, thanks to advancements in computational modeling, viz., mathematical models, simulations, and algorithms, a granular understanding of how road networks influence microeconomic dynamics (i.e., firm productivity, and household welfare), has been certified.

A number of studies have employed econometric frameworks to estimate the causal effects of road investments. For instance, Wan et al. (2024) quantified how increases in market access due to road expansions in Europe between 1990 and 2012 boosted regional GDP by up to 2.2%

in Eastern Europe, and employment by an average of 0.7%. Akbulaev and Bayramli (2022) examined road upgrades in Azerbaijan, and identified long-run gains in real income and manufacturing employment using a spatial equilibrium model and district-level data. Similarly, Raimbekov et al. (2023) used panel data from 351 metropolitan areas in Kazakhstan to show sector-specific employment and GDP benefits resulting from highway investments. Besides, many prior research illustrated that good road systems affect market integration (Kim, 2011), production specialization (Kim & Youn, 2020), and labor allocation (Lee & Zhai, 2013) thank to reducing transportation costs and improving connectivity.

Recent empirical studies also demonstrate a significant positive correlation between road networks and economic development, albeit with varying magnitudes and contexts. More specifically, the research of Owusu-Manu et al. (2019) on road infrastructure in Sub-Saharan Africa using cross-sectional regressions found that a 10% increase in road density correlates with a 2.5% rise in regional GDP. Njoh (2000) also had the same finding. Furthermore, some studies on China's National Expressway Network found that good road networks reduce travel time between cities by about 19-25% (Summers, 2016; Ying et al., 2014), as a result, leading to an approximately 3.2-4.6% increase in regional economic output (Magazzino & Mele, 2021; Zhou et al., 2022).

Although the existing literature on the economic impact of road networks on regional economies is vast, several research gaps should be addressed. First, the prior research predominantly relies on aggregate measures of economic performance, such as GDP growth (Hlotywa & Ndaguba, 2017), employment-to-population ratio (Muzapu et al., 2018), inflation rate (Li et al., 2018), and foreign direct investment (Summers, 2016). Accordingly, the distributional effects of road networks are often masked. On top of that, studies at the micro-level, viz., firm productivity, household welfare, etc., are relatively scarce.

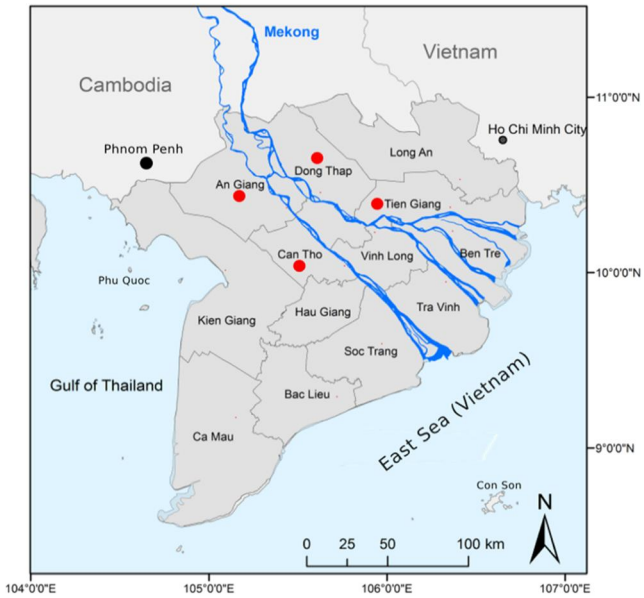
3. Research Methods

3.1. Sampling

The Mekong Delta (MD) is a vast and fertile region in the southernmost part of Vietnam, where key economic sectors include agriculture (i.e., aquaculture, rice farming, etc.), eco-tourism, and light industries (i.e., food processing, cabinetry work, etc.). Besides, this area spans about 40,500 square kilometers with 13 provinces, as seen in Source: Drawn by authors.

Figure 1, with Can Tho being the capital city of MD (Park, 2024). Moreover, DM has an extensive road network, but much of it is underdeveloped or in poor condition due to the region's geography, with vast rivers, canals, and wetlands (Yuen et al., 2024). On top of that, primary National Highways (i.e., National Highway 1A, National Highway 60, National Highway 80, and National Highway 91) connect MK to Ho Chi Minh City and the rest of Vietnam (Duy et al., 2025). To verify the effect of the road network on economic development, this paper surveyed 800 households during 2020-2022 in four major provinces in this area, including Can Tho, An Giang, Dong Thap, and Tien Giang, as shown in the red dots of Source: Drawn by authors.

Figure 1.



Source: Drawn by authors.

Figure 1: Research Site

3.2. Questionnaire Design

After determining the target respondents, the paper designed the draft questionnaire for data collection. Next, before full-scale implementation, pilot testing was carried out with 120 households to identify potential issues with question clarity, smooth transitions between sections, the time needed to complete a questionnaire, and cultural appropriateness. After that, thanks to feedback from the pilot test, the official questionnaire was finalized for full-scale implementation. It also included three main parts: sociodemographic characteristics of households, income-generating activities, and road network perception.

3.3. Data Collection

This research collected data via face-to-face interviews with households who lived in four central provinces in MK, including Can Tho, An Giang, Dong Thap, and Tien Giang,

as noted earlier. Additionally, to ensure the reliability and validity of the survey, data collectors were trained extensively in administering surveys and conducting interviews. In addition, the data collection process adhered to ethical considerations. More specifically, participants were informed upfront about the study's purpose and rights, including the option to join the interview and withdraw at any time. Vietnamese consent forms were provided before data collection began in case they agreed to participate. Anonymous responses also maintained privacy and confidentiality.

After the data collection phase, the paper conducted a thorough review of all returned questionnaires to detect the abnormality of collected data. To ensure data quality and maintain consistency in the empirical analysis, the paper applied a listwise deletion approach to remove any questionnaires that contained missing values in key variables of interest (Neto et al., 2019; Xu et al., 2016; Zhou et al., 2022). This decision could avoid potential biases and inconsistencies from incomplete responses, especially given that the missing data were not systematically concentrated in any particular demographic group (Cruz et al., 2015; Zhang & Cheng, 2023).

3.4. Estimation Techniques

To analyze the impact of the road network on the economic development of the Mekong Delta region of Vietnam, this study proposes a panel regression model, as follows (Moon & Weidner, 2017; Wood, 2013; Wooldridge, 2019):

$$Y_{ijt} = a_0 + a_1 X_{ijt} + a_2 D_{jt} + u_{jt} + v_{jt} + \varepsilon_{jt} \qquad (1)$$

Where:

Y represents the dependent variables, reflecting various factors related to economic development in the Mekong Delta region of Vietnam. Particularly, the dependent variables in this study include total income (in 1,000 VND), the proportion of non-agricultural income (%), total household expenditure (in 1,000 VND), and the average working time of households in a year (in months).

X demonstrates the variables reflecting household characteristics (e.g., age, years of schooling, number of workers, etc.).

D is a dummy variable as a proxy of the quality of the road network in the localities. This variable takes two values: 1 if the road network is good, and 0 if otherwise. Note that the degree of impact of road network connectivity on local economic development is expressed through the parameter a_2.

The subscripts i, j, t represent the i-th household in the j-th locality at time t ($t = 1, 2, 3$).

u represents all unobserved factors that vary between individuals but do not change over time.

v represents all unobserved factors that vary between individuals and over time.

ε is the random error term of the proposed model.

Model (1) will be estimated using four methods: the Ordinary Least Squares (OLS) method, the Random-Effects Interaction (REI) method, the Random-Effects without Interaction (REWI) method, and the Fixed-Effects (FE) method.

4. Results and Discussions

4.1. The Impact of the Road Network

Using STATA, the estimated results of Model (1) representing the impact of the road network on economic development in the Mekong Delta of Vietnam are presented in Table 1. Note that Table 1 only presents the estimated results of the impact of the road network.

Table 1: The Estimates of the Impact of the Road Network Using Regressions

Dependent variables	Regression models			
	OLS	REWI	REI	FE
Total income (in 1,000 VND)	31698.57 (0.000)	30686.38 (0.000)	31659.05 (0.000)	31103.98 (0.003)
Total household expenditure (in 1,000 VND)	44147.67 (0.010)	44055.83 (0.008)	44781.47 (0.007)	46315.5 (0.022)
The proportion of non-agricultural income (%)	9.06 (0.000)	9.31 (0.000)	9.31 (0.000)	9.05 (0.000)
The average working time of households in a year (in months)	0.69 (0.000)	0.69 (0.000)	0.69 (0.000)	0.91 (0.000)

Source: Survey data, 2023.

Note that:

Notes:

(1) Numbers in parentheses represent the significance level of the estimates.

(2) For the Random-Effects Interaction (REI) model, the regional dummy variable is interacted with household characteristics (e.g., education level, household size, total number of workers in the household). As a result, there are 9 interactions.

(3) Income and expenditure for 2020 have been deflated to allow for comparison with 2022.

Table 1 indicates that the road network has a positive impact on economic development indicators in the Mekong Delta region of Vietnam, with a significance level of 1%. Specifically, improved road connectivity increases total household income by between 30,686.38 thousand VND and 31,698.57 thousand VND. The estimation results show little variation across the different regression models. Additionally, good road connectivity can increase household expenditures by between 44,055.83 thousand

VND and 46,315.5 thousand VND. Among the models, the Fixed Effects (FE) model produces the highest estimates compared to the other three methods.

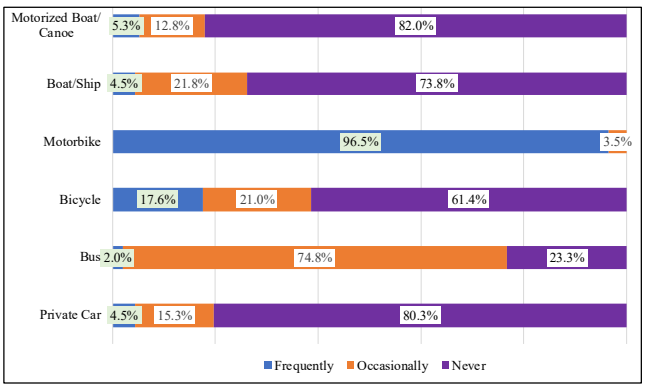
4.2. The Use of Transportation Modes in Economic Activities

The types of transportation modes and their frequency of use in economic activities in the Mekong Delta region of Vietnam are presented in Table 2 and Figure 2 below.

Table 2: Mode of Transportation (%)

Mode of Transportation	Frequently	Occasionally	Never
Private Car	4.50	15.30	80.30
Bus	2.00	74.80	23.30
Bicycle	17.60	21.00	61.40
Motorbike	96.50	3.50	0.00
Boat/Ship	4.50	21.80	73.80
Motorized Boat/Canoe	5.30	12.80	82.00

Source: Survey data, 2023.



Source: Survey data, 2023.

Figure 2: Frequency of the Mode of Transportation

Overall, six types of transportation modes are commonly used in the Mekong Delta of Vietnam, including private cars, buses, bicycles, motorbikes, boats/ships, and motorized boats/canoes. In terms of usage frequency, motorbikes and bicycles have the highest frequency of use, at 96.5% and 17.6%, respectively. This statistic indicates that the vast majority of people in the Mekong Delta of Vietnam rely on motorbikes as their primary means of transportation for economic activities.

The primary reasons for this reality stem from the unique geographical, economic, and cultural conditions of the research site, which create an ideal environment for the widespread preference and use of motorbikes and bicycles as the main means of transportation in daily life. Conversely, private cars and buses are the two least-used road transportation modes by residents. One reason for this is the narrow and small roads in the region, which make it difficult for private cars and buses to navigate. Another reason is the economic conditions of the local population, which limit their ability to purchase private cars for commuting purposes.

Therefore, to encourage people to use public transportation (such as buses), the first and most important solution is to invest in public transportation infrastructure, particularly a modern and convenient bus network. This includes developing routes, bus stations, and transit hubs to make it easier for residents to access and use buses.

4.3. Assessments of road network

Table 3 presents the residents' evaluations of road infrastructure in the Mekong Delta of Vietnam. It shows that 83.1% of the assessments indicate that the distance from households to public service areas (e.g., commune/ward government offices, health centers, schools) is considered "relatively close" or "average." Consequently, over 96% of households believe that road connectivity in their locality is "relatively convenient" or "very convenient" for their needs. Furthermore, nearly 95% of residents rate the quality of transportation infrastructure as "average" or "good." Similarly, nearly 96% of residents consider the availability of the road system as "relatively convenient" or "very convenient" for their family's needs.

Table 3: Resident Perception of the Road Network in the Mekong Delta of Vietnam

Items	Evaluation	%
Distance from household to public service areas	Relatively close	42.3
	Average	40.8
	Relatively far	17
Quality of road infrastructure in the household area	Not good	5.1
	Average	64.3
	Good	30.6
Convenience (availability) of roads for household needs	Not convenient	4.5
	Relatively convenient	70.8
	Very convenient	24.8
Connectivity and integration of transportation types	Not convenient	4
	Relatively convenient	70.8
	Very convenient	25.3

Source: Survey data, 2023.

4.4. Roles and Benefits of Road Network for Household Production

Table 4 summarizes household evaluations regarding the role and benefits of the road network for production and business in the context of sustainable development, including economic, environmental, and social impacts.

Overall, there are almost no responses indicating "strongly disagree," except for criteria such as "easier access

to agricultural, forestry, and fisheries processing facilities" and "reducing noise pollution from vehicles." Moreover, many criteria are rated as "agree" or "strongly agree" by over 50% of respondents, including "facilitating the transformation of agricultural production structures," "contributing to business expansion," and "enhancing the value of agricultural goods." Social-related criteria are particularly highly rated, such as "convenience for healthcare access" (68%) and "facilitating local education" (71.8%).

Table 4: Roles and Benefits of Road Network for Household Production

Criteria	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Economic Benefits					
Improving household income	0	17.8	42.8	37.3	2.3
Easier job access	0	20.8	37.8	38.8	2.8
Facilitating agricultural production shift	0	8.3	39	48.8	4
Supporting business transformation	0	5	45.3	43.8	6
Contributing to business expansion	0	10	38.8	48.5	2.8
Improving goods trade and sales	0	7.9	43.7	47.8	0.5
Enhancing the agricultural product value	0	12	38	47.3	2.8
Increasing agricultural land area	0	6.8	72.5	20.8	0
Easier access to processing facilities	1.3	15.8	48.8	34	0.3
Saving time and costs for transportation	0	6.5	35.8	57.3	0.5
2. Social Benefits					
Convenience for healthcare access	0	4	28	62.3	5.8
Facilitating local education	0	6.5	21.8	66.5	5.3
Better access to public services	0	6	72.5	21.3	0.3
Access to cultural events and festivals	0	5.3	46.3	48	0.5
3. Environmental Impacts					
Reducing dust pollution	0	5.5	42.3	49.3	3
Improving road traffic safety	0	6.5	47.5	43	3
Reducing noise pollution from vehicles	0.3	14.8	34.5	47.5	3

Source: Survey Data, 2023.

4.5. Discussions

Previous studies have shown that the proportion of non-agricultural income plays a crucial role in assessing the sustainable economic activities of farming households (Duy et al., 2025; Hlotywa & Ndaguba, 2017; Li et al., 2018). In this study, good road network connectivity increases the proportion of non-agricultural income from 9.05% to 9.31%. The REWI and REI models yield the highest estimates (9.31%), which are higher than the other two models. Moreover, household working time increases by 0.69 to 0.91 months due to good road connectivity. For this indicator, the FE model produces the highest estimates compared to the other three models. This finding is so consistent with that of Zhou et al. (2022)

Further, the empirical finding highlights a generally favorable perception of road networks in the Mekong Delta of Vietnam, particularly regarding the convenience and accessibility of roads for household and public service needs. However, the "average" ratings for both distance to public services and road quality suggest that there are opportunities for improvement. It is argued that addressing these areas through strategic infrastructure investments and maintenance could further enhance accessibility (Duy et al., 2025), road quality (Yuen et al., 2024), and overall satisfaction among residents (Park, 2024). Additionally, Ying et al. (2014) suggested that ensuring that underrepresented groups in remote and underserved areas can benefit from these improvements, will be crucial for equitable development.

Moreover, the results demonstrate that road network expansion positively impacts economic activities in the Mekong Delta of Vietnam. In addition to monetary benefits, environmental and social impacts are also significant due to improvements in local road connectivity. For example, better road infrastructure facilitates goods transportation, reduces time and costs, enhances trade, and stimulates economic growth. This finding is in agreement with that of Zhou et al. (2022) and Wang et al. (2021). Environmentally, it is highly admitted that effective transportation systems reduce congestion, travel time, fuel consumption, and emissions (Magazzino & Mele, 2021), thus improving air quality (Yang et al., 2018) and reducing environmental pollution (Yang & H. Bell, 1998). Socially, a strong transportation network improves access to essential services, viz., education (Ruiz & Guevara, 2020), healthcare (Fraser & Chester, 2016), and recreation (Neto et al., 2018), and in

turn, boosting urban development (Njoh, 2000) and enhancing the quality of life (Maparu & Mazumder, 2017).

When it comes to basic assumption, OLS treats the stacked panel as one large cross-section; therefore the unobserved unit effect (c_i) is uncorrelated with every regressor in every period while the composite error is homoskedastic and serially independent (Hu et al., 2018; Lee & Zhai, 2013; Owusu-Manu et al., 2019; Raimbekov et al., 2023). Meanhile, it is argued that RE estimators relax OLS assumptions by adding a unit-specific random intercept (Neto et al., 2018; Ruiz & Guevara, 2020). Still, it requires orthogonality between c_i and the regressors. Conversely, REWI obtains efficiency by weighting observations with estimated variance components, whereas REI applies feasible GLS without those weights (Sharma & Vohra, 2009). Accordint to Ruiz and Guevara (2020), FE removes c_i through time-demeaning, allowing the intercept to correlate freely with the regressors. Most importantly, because FE sacrifices between-unit information, it can be less efficient than correctly specified RE.

4.6. Robustness test

To assess the stability of our findings, we performed a split-sample robustness exercise. The full dataset (n = 800) was randomly partitioned into two mutually exclusive subsamples: Group 1 (n = 200) and Group 2 (n = 600). For each subsample we re-estimated the baseline specification using four alternative estimators—ordinary least squares (OLS), random-effects with individual weights (REWI), random-effects independent (REI), and fixed effects (FE). The results are reported in Table 5.

Across all four estimators, the point estimates obtained for Group 1 and Group 2 are virtually identical in both sign and magnitude, and their associated standard errors overlap substantially. Formal equality-of-coefficients tests yield p-values well above conventional significance thresholds ($p > 0.10$ in every case), indicating that the null hypothesis of equal coefficients between the two subsamples cannot be rejected. Taken together, these results demonstrate that our main conclusions are not driven by any particular subset of observations and are therefore robust to sample composition.

Table 5: The Robustness Check of Estimates

Dependent variables	OLS			REWI			REI			FE		
	n=200	n=600	p-value	n=200	n=600	p-value	n=200	n=600	p-value	n=200	n=600	p-value
Total income (in 1,000 VND)	31432.65	31581.22	0.2405	30587.22	30675.38	0.4360	31476.11	31598.17	0.1196	310983.32	31029.78	0.1390
Total household expenditure (in 1,000 VND)	44096.82	44035.54	0.3060	44209.69	44021.74	0.4292	44634.23	44521.38	0.1331	46259.1	46298.47	0.8567
The proportion of non-agricultural income (%)	9.11	9.03	0.9393	9.23	9.25	0.0984	9.13	9.11	0.5489	9.22	9.32	0.1816
The average working time of households in a year (in months)	0.55	0.67	0.2824	0.67	0.67	0.4135	0.63	0.65	0.0103	0.89	0.89	0.6318

Source: Survey Data, 2023.

5. Conclusion

5.1. Conclusion

This current paper aims to assess the effect of the road network on economic development with the case study of the Mekong Delta of Vietnam. To obtain the research objective, the article uses STATA to conduct four types of regressions, including OLS, REI, REWI, and FE. Some conclusions are as follows:

First, the regression results indicate that the improvement of the road network positively influences key economic indicators, including total household income and expenditures. More specifically, the findings show that a better road network increases household income by 30,686.38 to 31,698.57 thousand VND and household expenditure by 44,055.83 to 46,315.5 thousand VND. Among the four regression models, FE, which yields the highest estimates, suggests that localized improvements in infrastructure are particularly impactful. Furthermore, the findings reveal that road connectivity facilitates a shift toward non-agricultural income, with an increase in its proportion by 9.05% to 9.31%. This diversification of income sources underscores the importance of road networks in enabling economic resilience and adaptability, consistent with previous studies, for instance, Duy et al. (2025) and Hlotywa and Ndaguba (2017).

In addition to economic benefits, enhancing road connectivity extends the working time for households by 0.69 to 0.91 months annually, thus improving productivity and labor participation. The positive correlation between infrastructure quality and work time suggests that

accessibility to economic hubs and reduced travel constraints play a pivotal role in boosting household economic activities. Further, the analysis of transportation mode usage in economic activities further supports these findings. For instance, the overwhelming reliance on motorbikes (96.5%) and bicycles (17.6%) reflects the region's geographical, cultural, and economic context, which favors low-cost and adaptable transportation modes. However, the limited use of private cars and buses, primarily due to narrow roads and economic constraints, emphasizing an area for potential improvement. Expanding public transportation infrastructure, such as bus networks, with modern facilities and strategic routing, can help reduce dependency on motorbikes, thus alleviate congestion, and create more equitable transportation solutions.

The residents' evaluations of the road network provide much information for local government in proposing policies for the improvement of the road network. It is argued that over 96% of households perceive road connectivity as "relatively convenient" or "very convenient," and nearly 95% rate the quality of transportation infrastructure as "average" or "good." However, the significant proportion of "average" ratings suggests room for targeted investments to enhance road quality, connectivity, and integration of transportation systems. Strategic upgrades to infrastructure can address disparities in access, particularly for remote and underserved areas (Sharma & Vohra, 2009), ensuring inclusive economic growth and equitable development (Rawat & Sharma, 1997).

In addition, the benefits of road networks extend beyond economic metrics. In particularly, the role of road infrastructure in facilitating access to essential services, such as healthcare and education, underscores its social impact. For instance, 68% of respondents rated road networks as beneficial for healthcare access, while 71.8% highlighted their importance in supporting education. These findings are consistent with prior research showing that the enhancement of transportation networks contributes to human capital development by boosting access to critical services (Magoutas et al., 2023; Yuen et al., 2024).

The empirical findings also show environmental benefits from the development of road networks, which can reduce congestion, fuel consumption, and emissions, thereby improving air quality and minimizing environmental degradation. These outcomes align with the broader goals of sustainable development and echo existing literature on the ecological advantages of efficient transportation systems (Hu et al., 2018; Owusu-Manu et al., 2019).

5.2. Policy Recommendation

First, the findings of this study demonstrate that improving road quality significantly boosts household income, expenditure, and non-agricultural income in the Mekong Delta. However, many respondents rated the current quality of roads as "average," indicating substantial room for improvement. Many prior research admits that enhancing road quality requires upgrading existing infrastructure to ensure durability and resistance to challenging conditions of the Mekong Delta, such as frequent flooding and soil erosion. Additionally, expanding the road network to underserved rural areas is essential to reduce disparities in economic opportunities. For instance, better roads can facilitate easier access to agricultural markets, help farmers sell their produce at competitive prices and diversify their sources of income.

Second, the study reveals that buses are among the least-used transportation modes in the Mekong Delta, largely due to the lack of a reliable public transportation network and narrow, underdeveloped roads. Therefore, developing a modern bus system is critical to reduce the dependency on motorbikes and bicycles, which currently dominate transportation in the region. Besides, the local government should promote public transportation to alleviate traffic congestion and reduce transportation costs for households, as a result enabling them to allocate more resources to productive economic activities.

Third, the Mekong Delta, which is characterized by a network of rivers and canals, necessitates the integration of road and waterway transportation. Currently, the lack of connectivity between transportation modes limits the region's economic potential, particularly for industries reliant on the movement of goods. Thus, integrating road, waterway, and rail systems can enhance logistics efficiency, reduce costs, and improve supply chain resilience. For example, building intermodal terminals where goods can be seamlessly transferred between trucks and boats significantly decreases agricultural product transportation time.

5.3. Research Limitations

This study provides valuable insights into the impact of road networks on economic development in the Mekong Delta of Vietnam; however, certain limitations must be acknowledged. First, the analysis relies on three-year data, which may not capture long-term trends or seasonal variations in road usage and economic activities. Therefore, future research could address this limitation by incorporating longitudinal data (at least five years) to better understand the dynamic effects of road connectivity over time. Second, the generalizability of findings is limited to the Mekong Delta of Vietnam. Thus, it is highly recommended that replicating the study in other regions with different geographical and socio-economic contexts could enhance the external validity of the empirical findings.

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