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ABSTRACT

On the Road to Better Life? Rural Road and Economic Development in Albania*

This study evaluates the impact of investment in rural roads on household welfare in Albania. Using a difference-in-differences method, we find that treated households experienced a 35-percentage point increase in the quality of roads relative to control households and reduced travel times to the nearest motorable roads. The study also demonstrates that the price and value of residential and farmland increased in the treated communities. Household heads in treated communities were less likely to be unemployed, and there was a higher incidence of self-employment in treated households, which seems to suggest a pattern of households shifting away from paid employment to self-employment in response to improved economic opportunities due to improved connectivity. The study does not find a significant effect on household income, but finds an increase in consumption expenditure. In general, these findings indicate that investments in rural roads have had positive impacts on the welfare of the family in Albania.

JEL Classification: 012, O18
Keywords: rural roads, income, food expenditure, Albania

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1 Introduction

In 2022, 43% of the world's population lived in rural areas. However, this figure is almost twice in developing countries. The relationship between rurality and poverty is stark: the poverty rate in rural areas is three times higher than in urban areas, with more than 80% of the world's poor residing in rural regions. Although poverty has multiple root causes that extend beyond basic necessities, rural transportation and infrastructure development are considered crucial factors in reducing poverty and fostering economic growth. In particular, the expansion and improvement of rural roads are viewed as essential investments to improve the lives of the rural poor and alleviate rural poverty (Hine et al., 2016).

In recent decades, substantial investments have been made in road infrastructure worldwide. The World Bank alone spent $161 billion in developing transport infrastructures between 1995 and 2015. In India, the flagship road program PMGSY has invested approximately $100 billion over the last two decades. Despite these significant expenditures, empirical evidence on the impacts of road investments remains mixed, with benefits distributed unevenly between different population groups, countries, and regions.

Contrary to the widely held belief that road investments have a positive multiplier effect on the economy and are crucial for sustained economic development, some studies have found a limited impact. For example, (Asher and Novosad, 2020) found no significant effect on income, assets, agricultural investments, or predicted consumption in India. They concluded that roads alone are insufficient to transform the economic conditions of remote villages, suggesting the need for complementary policies or investments. Other studies show that improved rural roads led to higher farm and non-farm production and income through increased availability of inputs and reduced input costs (Binswanger et al., 1993; Levy, 1996; Aggarwal, 2018).

Given substantial investments in rural road infrastructure and mixed evidence on its impacts on human welfare, it is crucial to examine whether rural roads promote eco-

nomic development and whether the benefits are equitably distributed across all areas and households, or are concentrated in specific regions or among households with certain characteristics. This study addresses this question in the context of Albania, a small mountainous country in southern Europe, situated in the western part of the Balkan Peninsula. Specifically, this study evaluates the impact of a rural road program, 'Secondary and Local Roads Project' (SLRP), on both economic and non-economic outcomes for households in rural Albania.

With financial support from the World Bank, the SLRP rehabilitated 1,500 kilometers of secondary and local road networks in all 12 regions of Albania. The primary goal was to improve the access of rural communities to essential services and markets. In the absence of a feasible randomized controlled trial, impact evaluations of infrastructure programs are challenging. This paper utilizes a credible quasi-experimental method, a difference-in-difference (DiD) framework, to estimate the plausibly causal impacts of SLRP on a series of outcomes related to household welfare. We collect household data before and after road construction and apply the DiD method to estimate impacts. Overall, our results show that the SLRP road projects led to significant positive impacts on various welfare outcomes.[1]

As first-order impacts, the results suggest that treated households experienced a 35 percent increase in road quality compared to control households, along with reduced distances and travel times to the nearest motorable roads. The study also finds that the value of residential land and farmland increased in the treated communities. Employment outcomes also improved, with household heads in the treated areas less likely to be unemployed, and a higher incidence of self-employment was observed in the treated groups. This suggests a shift from paid employment to self-employment, likely in response to the increased economic opportunities generated by better road connectivity. Interestingly,

[1]Households living in villages within five kilometers of the SLRP road were considered "treated" households and households living outside the 5-km radius were the control households.

the study does not find a statistically significant effect on household income despite an increase in consumption expenditure,

This paper contributes to the broader literature on the impact of improvements in roads and transportation infrastructure. It is one of the few studies in the European context, and the evaluation focuses on several key questions, such as whether the SLRP impacted the quality of the roads and improved the access to markets; whether it improved household income and affected expenditure on food and non-food items; and whether it increased the value of land or homes. These evaluation questions are important for the impact assessment of the SLRP because agriculture continues to remain the main sector of employment and income in rural Albania[2]. Thus, improved connectivity and better transport infrastructure could play a pivotal role in stimulating rural development and the welfare of households. By estimating the impacts of the SLRP in Albania, we contribute to the broader understanding of rural road improvement initiatives and their effectiveness in promoting development. This study offers valuable insights into the potential benefits and limitations of such infrastructure projects, particularly in mountainous developing regions.

2 Theory of change

The benefits of rural roads often operate through channels such as greater access to product and factor markets, along with reduced transportation, transaction, and time costs. Improved rural roads can also lead to higher farm and non-farm production and income by improving the availability and cost of inputs (Binswanger et al., 1993; Levy, 1996). However, only a limited number of studies have rigorously examined the causal impact of rural roads on household welfare. The lack of evaluation studies of road projects

[2]Around 20 percent of the Albanian GDP and half of the employment are concentrated in the agricultural sector. (World Bank national account data)

is mainly due to the endogenous placement of roads in villages. Endogenous placement of roads leads to selection bias and produces biased estimates.

Furthermore, the outcomes associated with improvements in rural roads may also be driven by endogenous factors such as domestic demand, market access, and socio-political objectives of the local stakeholders. The evaluation of any rural road program is further complicated by the varied and sometimes unequal impacts on different subgroups. Although improved road connectivity can improve access to markets and services, it may not be sufficient alone to reduce poverty or significantly increase household income. Additional complementary investments, particularly in human capital, may be necessary to fully realize the potential benefits of better connectivity.

Many rural areas possess characteristics that could limit the gains from improved roads, such as challenges in human capital accumulation and the lack of agglomeration benefits (Asher and Novosad, 2020). Although better roads often lead to increased transportation services, studies have not consistently found significant effects on income, assets, agricultural investments, or predicted consumption. This suggests that roads alone are insufficient to transform the economic conditions of remote villages unless accompanied by complementary policies or investments.

There is evidence that the benefits of rural road improvements are not equally distributed in all socioeconomic groups, since resource-rich households often benefit disproportionately from such improvements in infrastructure (Van de Walle and Cratty, 2002). Hine et al. (2016) argue that households with higher socioeconomic status, such as those with greater land ownership, better education, and more wealth, may be better positioned to take advantage of improved road infrastructure.

3 Previous Literature

3.1 Problems in evaluating infrastructure projects

The existing studies on the impacts of roads differ in several dimensions and thus show mixed impacts. These studies differ in terms of methodology, results analyzed, highway versus shorter roads, new construction versus improvements/upgrading of existing roads, and urban versus rural roads. The outcomes analyzed in these studies are diverse and include economic, social, political, and transport-related variables. In general, the findings of these studies are ambiguous and unclear, and therefore, drawing concrete conclusions about the impacts of rural roads remains elusive.

In general, impact evaluation studies of infrastructure projects, including roads, electricity, and dams, suffer from endogeneity problems. The endogeneity problems arise due to non-random program placement when road constructions are prioritized based on village or community characteristics such as local markets, agricultural productivity, traffic volume, access to public infrastructures, distance to urban areas, etc. These factors that determine the placement of roads can also have a direct impact on household welfare (Burgess et al., 2015).

3.2 Impacts on economic and labor market conditions

Escobal and Ponce (2002) used a propensity score matching technique to compare rural households living near rehabilitated roads in Peru and looked at the effects on income and consumption. They find that access to rehabilitated roads led to an increase in annual per capita income by $120 among treated households, mainly through a shift away from agriculture and towards wage employment. No income effect was detected for households near non-motorized roads. However, the authors find no effect on consumption expenditure and argue that the null effect is because the increased income was shifted to

savings through higher livestock purchases instead of consumption.

(Khandker et al., 2009)found that rural road investments in Bangladesh significantly reduced poverty by boosting agricultural production, wages, output prices, and lowering input and transportation costs, with greater benefits for the poor. (Lokshin and Yemtsov, 2005) evaluated a road rehabilitation project in Georgia and found improved off-farm opportunities, better emergency medical access for non-poor households, and increased female wage employment among the poor. Dercon et al. (2009) showed that road improvements in rural Ethiopia reduced poverty by 7% and increased consumption growth by 16%. Jedwab and Storeygard (2021) estimated that a 10% increase in market access due to road improvements in 39 African countries led to a 0.8%-1.3% increase in city populations, especially in remote and smaller cities.

Aggarwal (2018) Aggarwal (2018) finds that India's Pradhan Mantri Gram Sadak Yojana (PMGSY) improved urban-rural market integration, reduced prices, increased the availability of urban goods in villages, and increased adoption of agricultural technology. Asher and Novosad (2020) Asher and Novosad (2020), using micro-data and a fuzzy regression discontinuity design, found that four years after road construction, the main effect was moving workers out of agriculture, with no significant impact on agricultural outcomes, income, or assets, and only marginal increases in village employment. Shamdasani (2021) examines the impact of PMGSY on agricultural decisions and found that households residing in very remote villages who then receive access to improved connectivity, go on to diversify their crop portfolio.

Mu and van de Walle (2011) examined rural road improvements in Vietnam, finding no short-term impacts 27 months after completion. However, 4 years later, they observed significant effects on market presence, services, and a shift from agriculture to non-agricultural activities, especially in poorer communes. Gonzalez-Navarro and Quintana-Domeque (2016) found that street paving increased property values by 16%, land values by 54%, and rent by 31%, along with higher consumption of durable goods

in Mexico. Forston and Gonzalez (2015) evaluated rural road development in Armenia, noting improved perceptions of road quality, but no income effects were found. Linkow et al. (2015) found an increase in industrial facilities from a highway project in Georgia, but no significant impacts on income, consumption, or employment.

Jacoby (2000) found that the benefits of providing better access to the roads to markets in Nepal were not large enough or efficiently targeted enough to greatly reduce poverty and income inequality. Analyzing the effect of the Pradhan Mantri Gram Sadak Yojana (PMGSY) in India, Aggarwal (2018) echoes similar findings and concludes that road construction resulted in lower prices and increased availability of non-local goods in treatment villages, indicating greater market integration. In addition, access to roads and market integration also led to increased adoption of agricultural technologies. Asher and Novosad (2020) show that the construction of the PMGSY road leads to the reallocation of village labor from agricultural work to wage work.

Mu and van de Walle (2011) used a PS-matched DD method to study rural road improvements in Vietnam. They found no short-term impacts 27 months after completion. However, 4 years after the project, they observed significant effects on local markets, including increased market presence, frequency, and service availability.

3.3 Impacts on education

Several evaluation studies have also found positive effects of road improvements and construction on education. School enrollment can increase due to better connectivity. Investments in roads can also affect the supply side, as schools in connected villages are more likely to be better staffed and have better school infrastructure and input. In theory, better connectivity should increase school attendance and reduce dropouts, especially among female students. The demand for education may also increase due to higher returns to schooling in connected areas. Adukia et al. (2020) examine the impact

of India's PMGSY on educational choices in connected villages. They find an increase in school participation and test performance. The increase in enrollment was greatest in areas where nearby markets offer the highest returns to education. Similarly, positive impacts on school enrollment were also observed in India (Aggarwal, 2018), Bangladesh (Khandker et al., 2009), and Vietnam (Mu and van de Walle, 2011). Gonzalez-Navarro and Quintana-Domeque (2016), the only experimental study to estimate the impacts of road improvements, show that pavement in Mexico increased property value by 16%, land value by 54%, and rent paid by 31%. Households on the paved street also had a higher consumption of durable goods, especially motor vehicles, household appliances, and home improvements. Increased consumption is made possible via both credit use and less saving.

4 Sample selection and Data

4.1 Background of SLRP

The primary objective of the project was to improve access to essential services and markets by providing all-weather roads in rural parts of Albania. The Albanian Development Fund (ADF) was the implementing agency of this project. The improvement of the "Secondary and Local Roads Project" was cofinanced by 11 donors and financial institutions at an estimated cost of $400 million US dollars. The project aimed to rehabilitate approximately 1,500 km of the local road network in rural areas and covered all 12 regions of Albania. The duration of the project was from 2008 to 2017. Until June 2017, US$ 367.62 million has been spent to rehabilitate 144 secondary and local road sections and bridges, totaling 1,177 km of road network. These 144 road sections were expected to directly benefit one million inhabitants.

The study design uses a baseline survey that was conducted before the SLRP project

started and a follow-up survey after the completion of the treated road segments. The baseline survey was completed in March 2012 and the follow-up survey was completed in December 2016. From the inventory list of 144 local roads, on average, one treated and one control road segment was identified in each region. The initial treated road segment included 17 road segments (see Appendix Table A.1), and of these, 8 road segments were completed in 2012, 5 were completed in 2013, and 1 road each was completed in 2014, 2015, and 2016, respectively. However, due to financial constraints, one of the treated road segments in the Diber region could not be completed; therefore, effectively this road segment of the "Katuri-Poshtem" became the "control" road for evaluation. Civil work on the control road segments did not begin until the spring of 2017, which was after the follow-up survey was completed.

4.2 Selection of treated and control road segments

The implementing agency ADF prioritized the SLRP based on a score that is based on various objective economic and social criteria (weighting schemes varied according to the type of road—commune or regional). Construction expenditure targets were set for each region (Quark), and road segments were ranked within regions based on the score. As a general rule, project selection depended on having a score above the region-specific threshold. The Quark-specific eligibility score was used to determine the treated and comparison communities. Communities within a 5-km radius of the treated road segment were considered treated communities, and communities within a 5-km radius of the control road segment were considered control communities.

The ADF team scored each segment of the road on a scale of 0 to 100. The scoring was based on the following criteria: (i) Scale of expected impact on socioeconomic development; project compliance with local/regional priorities of national development strategies (40 points); (ii) impact scale on poverty reduction and increased access to basic services

(15 points); (iii) Number of direct beneficiaries (25 points); (iv) Physical condition of the road to be upgraded (20 points). The government of Albania faced financial and logistical constraints to simultaneously start the construction of all project roads. The implementing agency, ADF, shortlisted 34 road segments to be rehabilitated in the next 5-10 years.[3] ADF shortlisted 17 road segments that were prioritized to be constructed/rehabilitated in 2012, right after the baseline survey, based on geographic distribution, poverty level in communities, social and economic activities, and number of beneficiaries likely to be affected by road rehabilitation. The remaining 17 road segments were planned to be rehabilitated later, after the follow-up survey (see Table A1 in the Appendix).

4.3 Sample Design

This study is based on nationally representative data from 12 regions of Albania. The baseline household and community-level survey was conducted in 2012, and an identical follow-up survey was administered in November 2016. Communities within a 5-km radius of the proposed road segment formed the sample universe. From this sample of communities, 72 villages were randomly selected to identify the treated and control communities. The selected villages within a 5-km radius of the treated road segments (those rehabilitated in 2012) formed the treatment group, and the selected villages within a 5 km radius of the counterfactual road segments (to be rehabilitated in 2017) formed the control group.

In each selected village, 15 households were randomly administered the household survey. The baseline survey was completed for 2,160 households (1,081 treated households and 1,079 control households) living in 144 villages (67 treated and 77 control villages). The follow-up survey was completed during September-November 2016, approximately 4 years after the baseline survey. The follow-up survey interviewed 1,968 households

[3]The number of road segments ranged from 2 to 4 in each region.

in 2016. Of the follow-up sample of 1,968 households, 1,563 households were the same households that were interviewed in 2012.[4] The 2012 households that could not be traced in the follow-up survey were replaced by a random selection of a new household in the same village. Other household surveys used a similar replacement strategy as Desai and Vanneman (2015). In addition to household surveys, 144 community surveys and 10 focused group discussions (FGD) were also conducted in each region in 2012, as well as in 2016.

4.4 Survey instruments: Community and Household Survey

The community questionnaire was designed to collect detailed community-level information on the basic characteristics of the community and its access to social infrastructures, such as schools, hospitals, markets, migration, and economic activities in the community. Generally, respondents of the community surveys were elected or appointed leaders, teachers, health workers, and agricultural extension workers. The household survey consisted of sixteen sections and was based on the Albanian Living Standard Measurement Survey (LSM) conducted by the World Bank. Information was collected on the age, gender, marital status, literacy, and educational level of household members. Additional information was also collected on the economic activities of the household members and on their wage employment, distance to work, and commute cost, including other key variables.

[4]The attrition rate is 27%, which is comparable to other experimental studies. For example, the only RCT study of road evaluation in Mexico had an attrition rate of 27% (Gonzalez-Navarro and Quintana-Domeque, 2016). Attrition in our study was mainly due to the lack of identifiers and contact details of the respondents, and may be due to migration.

5 Empirical Methodology and Descriptive Statistics

5.1 Empirical Methodology

In the case of infrastructure projects like road programs, identification problems often arise due to the non-random or endogenous placement of the projects, which could lead to selection bias. In the evaluation of any road projects, endogeneity bias can occur when (1) initial conditions that are correlated with the road placement are also correlated with the outcome variables; for example, if roads are built in areas that have higher potential of cash crop, then the impacts will be biased because the initial conditions of the areas (potential of cash crop) will also affect the outcome, household income (agricultural income) and (2) when road placements are correlated with the time-variant factors (Van de Walle, 2008).

To circumvent such a problem, in the absence of a feasible randomized controlled trial, this study uses a quasi-experimental design, specifically a difference-in-differences (DiD) framework, to estimate the causal impacts of SLRP. Any other quasi-experimental method, such as an instrumental variables strategy or a regression discontinuity design, could not be used due to the unavailability of a suitable instrument or a well-defined cut-off point or a threshold above or below which the intervention could be assigned.

The DiD method used baseline data from 2012 and follow-up data from 2016 for treatment and control households. The main advantage of this approach is the possibility of accounting for differences in the time-invariant unobserved characteristics of the treated and control observations. The DID method compares the changes in outcomes between treated and control households in the pre-SLRP year (2012) to the same changes in the post-SLRP year (2016).

The empirical framework in this study is as follows:

$$y_{\text{ivr}} = \alpha + \beta_1 Treatment_{\text{ivr}} + \beta_2 After_{\text{ivr}} + \beta_3 (Treatment * After)_{\text{ivr}} + \beta_4 X_{\text{ivr}} + \eta_{\text{r}} + \epsilon_{\text{ivr}} \quad (1)$$

where y_{ivr} is the outcome variable (e.g., household income, commute cost to school/hospital/work; travel time, land value, etc) for individual i living in village v in region r. *Treatment* is a dummy variable indicating the treatment status for each individual i. The treatment is at the level of the village because the SLRP project considered all households living in a radius of 5 km of the road as treated households. In any infrastructure project such as access to electricity, roads, dams, and canals, it is often not feasible to vary the treatment at the household or individual level. After is a binary variable indicating whether the data is from the baseline (pre) or endline (post), or in other words, whether the data is from the period after the SLRP has started. *Treatment*After* is the interaction term between the two variables. X denotes individual or household level controls that may impact the outcome variables, such as household size, gender of the household head, education level of the head of the household, etc. η_r is region fixed-effects to control for fixed characteristics of the regions. It is quite plausible to imagine that regions are different, and there are some peculiarities about each region that should be captured in the analysis. And finally, ϵ_{ivr} is the error term [5].

Given that the treatment status is at the community/village level, it is likely that changes in household outcomes over time are likely to be correlated within villages. For example, households living in the same community may be affected similarly by the same weather and thus would have correlated outcomes. To address this concern, standard errors are clustered at the village level. The main coefficient of interest in equation (1) is β_3. β_3 is the causal impact of the SLRP project on the outcome variables.

[5] The identifying assumption is that in the absence of treatment or intervention, the treated and control communities would have followed the same trajectory over time in the outcomes. In other words, any differences between the treated and control groups prior to the intervention should remain constant or evolve similarly if the treatment had not been applied. However, due to the lack of data, we have limited scope to test the parallel trend in this study.

5.2 Descriptive statistics

Table 1 shows the descriptive statistics for the characteristics of the households in panel A, the heads of the household in panel B, and the assets and income of the household in panels C and D, respectively. The average age of the household members surveyed is 37.03 years. Individuals in the treated villages are slightly older (38.03 years) than those in the control villages (36.13 years). The difference in mean age is statistically significant at a 1 percent level of significance. There are no significant differences in the number of male household members or in marital status in the treated and control villages.

The overall literacy rate for household members older than 10 years is 97.13%. The difference in the proportions of literates in the treated and control villages is small and statistically insignificant. The sizes of the households do not show significant variations, with the mean size of the household, considering both treatment and control households, being 3.92 members per family.

The average age of household heads is approximately 54 years, with mean ages of 53 in the control areas and around 56 in the treatment areas, a difference that is statistically significant at the 5 percent level (panel B). Six percent of the household heads are female, with no statistically significant differences between the treatment and control villages. A slightly higher proportion of household heads are married in the treatment areas compared to the control areas. The literacy rate of household heads is also similar between the two groups.

The unemployment among household heads is lower in the treatment areas compared to the control areas, a difference that is statistically significant at the 1 percent level. The average distance from home to work[6] is slightly shorter in the treatment areas, but this difference is not statistically significant. On average, households in SLRP-beneficiary villages travel 1.3 km less to work than those in control areas.

[6]Based on responses from 509 households.

Panels C and D present descriptive statistics on agricultural and non-agricultural assets and incomes. The value of residential houses, including land, was markedly higher in the treated households compared to the control households; on average, the value of houses and land in the treatment area was 2.74% higher, and the difference is statistically significant. A key factor contributing to this disparity is the larger average plot size in the treatment areas.

Around 10% of the households in the treatment areas owned a second piece of residential land within the commune, compared to only 6.9% in the control areas. This difference is statistically significant at the 5 percent level. The price of residential plots in the treatment areas was also higher, averaging 0.51 million Lekë/ 100 square meters, while in the control areas it was 0.19 million Lekë per 100 square meters.[7]

The monthly cash income from paid employment is higher in the treatment areas compared to the control households, but this difference is not statistically significant. In contrast, non-wage, non-crop income is significantly higher in the treatment areas, with this difference being statistically significant at the 1 percent level.

However, non-crop agricultural income is significantly lower in treatment areas compared to control areas, suggesting that households in the treatment areas may be less dependent on livestock rearing for their income. However, business income in the treatment areas is considerably higher, averaging 45,620 Lekë, which is more than three times the 12,341 Lekë earned by control households. This difference is also statistically significant at the 1 percent level, indicating substantially better business earnings in the treatment areas.

[7]These land prices are based on data from approximately 420 households (245 from treatment areas and 175 from control areas). Due to the infrequency of residential land transactions in rural areas, few households were able to provide price information.

6 Results

6.1 Impact of SLRP on road conditions, distance, and time to motorable road

The short-run impacts of improved rural roads are likely to be on access to key economic and non-economic institutions. Access can be measured by the distance and time taken to travel to a particular institution, such as schools, hospitals, markets, etc. These are immediate and short-term results of improved road quality and access. Therefore, we first estimate the impact of SLRP on three outcomes related to access and quality of road: (1) condition of the road, (2) distance to the nearest motorable road, and (3) travel time to the nearest motorable road from home.

The analysis is based on the information collected in the household survey on the access and quality of the nearest motorable road. The survey respondents were asked to rank the condition of the nearest motorable road as very good, good, bad, poor, and very poor. We grouped "very good" and "good" as one category.[8]

The results in Table 2 show that the SLRP program improved the conditions of the roads in the treated communities compared to the control communities. We find that SLRP led to an improvement in the condition of the road by 35 percentage points, and the estimate is statistically significant at a 1% level of significance. Similarly, the results further demonstrate that SLRP led to a significant decrease in distance and travel time to the nearest motorable road. The treated households (households living in the treated communities) experienced a reduction in the distance to the nearest motorable road by 2.1 km compared to the control households. The estimate is precise, and the null of no impact is rejected at the 1 percent level. The results in column (3) indicate decreases

[8]Approximately, 30% of the sample reported that the nearest motorable road is in either good or very good condition. In the baseline survey, only 13.75% of the respondents rated the condition of the road as good, but in the post-intervention period after SLRP in the 2016 data, the percentage rating of the condition of the road as good increased to 48%.

in the travel time to the nearest motorable road by 9.6 minutes in the treated villages compared to the control villages. Overall, the results in Table 2 show that the SLRP project had significant positive impacts on access to the nearest motorable road from home and improved road conditions.

6.2 Impact of SLRP on socio-economic outcomes

6.2.1 Impact of SLRP on residential and farmland value

Improved road connectivity positively impacts home and farmland values by increasing land demand and home prices near better roads. Research in developed countries, such as (Levkovich et al., 2016), found that highway construction increased housing prices in municipalities near highways, despite externalities such as pollution and noise. However, this effect may be less pronounced in rural areas of developing countries. Due to limited data on land sale transactions in rural areas, it is often difficult to determine the market price of land or houses. Usually, a sale transaction is the best method of capturing reliable information on the value of the land or the home. However, the SLRP survey asked respondents about the average price of residential land in their community and the current market value of their house. About 60% of endline respondents did not know the value of their current home and about 420 out of 1,968 endline respondents could provide the average price of residential plots in their commune.

The results in Table 3 show that the value of the house is higher in the treated communities than in the control communities.[9] The results indicate that the current market value of the home is greater by 0.7 million Lekë in the treated communities, but the results are statistically insignificant. The estimate in column (2) shows positive impacts on the price of residential land. In the communities that benefited from the SLRP, the price of residential plots is higher by 0.29 million Lekë per 100 sq meter

[9]The home value and price of residential land are reported in million Lekë.

compared to the price of land in the control communities. As demonstrated in column (3), there is a statistically significant positive impact on the price of farmland in communities that benefited from road projects. The households that have benefited from the SLRP projects have experienced an increase in the price of farmland of 787 Lekë per square meter compared to the control households.

6.2.2 Impact of SLRP on access to work, employment, and income

Improved connectivity and investments in roads could make travel easier, reduce transportation and transaction costs, and improve employment opportunities for treated households. Table 4 presents the results on the impact of SLRP on the access to work, employment and income of the household heads. Table 4 column (1) shows that the participants (household heads) located near the SLRP road projects experienced reductions in the travel time to their work by 9.7 minutes. The model in column (1) controls for the distance to work from home because distance is an important predictor of travel time; and the models in columns (2), (3) and (4) of Table 4 have controlled for the age and education of the head of the household because these variables are important predictors of income and earnings.

From the estimates in columns (2) and (3), we find that the road projects had significant negative impacts on unemployment and positive impacts on self-employment. Results suggest that treated household heads are 12 percentage points less likely to be unemployed compared to those in non-treated households. We also find that, conditional on being employed, household heads in the treated communities are more likely to be self-employed than those in the control groups. Results estimate an effect of 13 percentage points, comparable to the effect on unemployment. Column (4) explores SLRP's effect on the income earned by the household head through employment. The average monthly income of the household head in treated communities is approximately 22000 more Lekë than in the control communities, but this estimate is not statistically significant.

6.2.3 Impact of SLRP on household income

Improvements in rural road infrastructure are expected to enhance household income by expanding access to employment opportunities and markets. We examine the effects of SLRP on household income in Table 5. Table 5 presents estimates for three income measures: monthly employment income, income from non-employment or business sources (e.g., livestock sales, business income, pensions), and annual total household income (the sum of employment and non-employment income)[10]. Our findings do not indicate any statistically significant impact of the road rehabilitation program on any of these income measures. The estimation yields negative regression coefficients for household income and business income; however, no inference can be made due to the statistically insignificant coefficients.

While the SLRP led to improvements in road quality, property values, and self-employment, we do not observe any statistically significant changes in household income. These results are consistent with prior studies in similar contexts (Forston and Gonzalez, 2015; Linkow et al., 2015), which found no short-term income effects of road investments in Armenia and Georgia. Several plausible explanations may account for this null finding. First, income effects from infrastructure investments often materialize over longer time horizons following road project completion (Khandker et al., 2009; Cuong, 2011; Mu and van de Walle, 2011). Households may require more time to adjust to new economic opportunities, invest in new ventures, or reap returns from improved connectivity. As Mu and van de Walle (2011) emphasizes, income gains from improved infrastructure often emerge only over longer time horizons after households have adjusted their labor allocation, investment decisions, or migration patterns. Second, the types of income-generating activities facilitated by better roads—such as small businesses or market-oriented farm-

[10]The survey asked respondents about income from non-farm activities such as livestock sales, sale of livestock products, sale of dairy products, other animal by-products, vegetables, fruits, forest produce, etc.

ing—often involve upfront costs and risks, which may delay observable gains. Third, measurement error in self-reported income, common in household surveys, can attenuate treatment effects, particularly for variable and informal income. In contrast, household consumption, which is less prone to recall bias and is considered a more reliable welfare indicator in low-income settings, shows a positive response. This reinforces the idea that infrastructure can initially affect household well-being through improved access to goods and services rather than immediate income gains. Finally, general equilibrium effects—such as increased competition or changes in input prices—may offset potential income gains for some households, especially in areas where market integration remains weak or where complementary inputs, such as credit and skills, are lacking.

Moreover, qualitative evidence from focus group discussions suggests that new businesses—such as small retail shops and restaurants—did emerge along the improved roads. However, the sample size for these enterprises remains limited, reducing statistical power to detect effects in the regression models. There were 141 households engaged in retail shops, 81 in the restaurant/bar business, 93 in small cottage enterprises, and 42 were engaged in small contracting businesses. Finally, given the inherent difficulty in accurately measuring household income in surveys—especially in contexts with informal and seasonal earnings—consumption is often considered a more reliable welfare indicator. We therefore turn next to estimating the program's impact on household consumption expenditure.

6.2.4 Impact of SLRP on consumption expenditure

The beneficial impacts of road improvements can also manifest in increased consumption expenditure. Household consumption expenditure could be a better indicator of the socioeconomic status of the household compared to household income. Households are assumed to report a better picture of consumption than income in surveys, and in the end, income is a means to achieve better consumption, which is the ultimate objective of development policies. The consumption measure of household welfare is a useful indicator

to complement the income measure due to the lower variability in consumption from year to year than income (Deaton, 1997). In this spirit, the SLRP collected information on 52 food items and 20 non-food items. The consumption measure is based on a detailed household consumption diary. The survey asked for the quantity consumed and the price paid in the past month for each of the 72 items. Expenditure on each food and non-food item was calculated by multiplying the total quantity consumed by the unit price of that item.

Table 6 reports the impacts of SLRP on consumption expenditure. Overall, results indicate that the SLRP project had positive impacts on household expenditure on food and non-food items. Estimates for the three outcome variables are positive and significant at standard levels, except for food expenditure. Treatment households spend 2,878 Lekë more on consumption than comparison households, and the effect appears to be driven by the significant impact on non-food items. The impact on non-food expenditure is about 2,843 Lekë. The impact on food expenditure is small and positive, but is not statistically significant. One plausible explanation for this result could be that the income elasticity of food is small and the Engel curve is steeper for necessary goods, such as food as compared to luxury items. The demand for food is income inelastic; therefore, the share of food in the budget would not fluctuate much and would be insensitive to income shocks or other changes in the household.

6.3 Attrition

The endline survey was completed in September through November 2016, approximately 4 years after the pre-intervention survey. Of the baseline sample of 2,160 respondents, approximately 1,563 households were successfully resurveyed in 2016, representing an attrition rate of 27%. The attrition rate is comparable to RCTs studied on road evaluation (Gonzalez-Navarro and Quintana-Domeque, 2016). These households could not be tracked

due to missing contact details and out-migration. Following Desai and Vanneman (2015), the follow-up survey replaced the non-tracked household with a new household in the same village.

From an estimation point of view, missing households should not systematically differ across the treatment and control groups. The distribution of sample attrition provided in Appendix Table A.2 indicates that approximately 74.6% of the treated households were interviewed in 2016, while the percentage stands at 70.9% for the control households. Households in control villages were slightly more likely to be missing in the 2016 endline survey. However, this would not be problematic if we could show that the difference in the probability of missingness by treatment status is not statistically significant.[11]. Moreover, for the impact analysis, a representative sample of the control and treatment villages is needed before and after the SLRP. Since the SLRP treatment is at the village level and the replacement households were selected from the same set of villages, the 2016 endline survey is a representative sample, and missingness would not bias the main impact estimates in any significant way.

However, in Appendix Table A.3, we present the results of a robustness check to see if there are any systematic differences in the households who could not be resurveyed and those who were resurveyed in 2016. In column (1), the result *'not resurveyed at the endline'* is a binary variable and coded as one for households that were in the baseline but not at the endline and is regressed in the SLRP * Year (2016) variable. Additionally, in column (2) the attrition dummy is regressed on the treatment status (SLRP), and we check if the treatment coefficient is significant. In both columns, the results indicate that, after controlling for the region fixed characteristics, neither the coefficients for SPRP*Year (2016) in column (1) nor SLRP in column (2) are statistically significant. From these results, we are confident that attrition in this project is unlikely to have introduced bias

[11] Composition of the surveyed sample may have changed due to differential survey response rate or differential migration (Tarozzi et al., 2015)

in the sample and the results. Therefore, DID on the longitudinal data of 967 households can also be used but we decided to use all surveyed households, including the replaced households as a repeated cross-section. Our preferred approach is DID with a repeated cross-section of 2,160 baseline households and 1,968 endline households, a total of 4,128 households, and all analyses always used the full sample of 4,128 households.

7 Heterogeneity Analysis: Impacts by the topography of the region

Another important consideration in an impact analysis is the possibility that the benefits of improved roads and better connectivity are not experienced uniformly across households, communities, or regions (Mu and van de Walle, 2011; Forston and Gonzalez, 2015; Nguyen et al., 2017).

The benefits of roads may also vary by the relief or topography of the areas. Since the most direct benefit of better roads is improved connectivity, access, and shorter travel time, the impacts in mountainous and hilly regions will differ from the impacts in plain regions. Albania's topography is a mix of mountainous, hilly, coastal, and plain regions, and thus this study categorized 12 regions into two groups: mountain and plain.[12] [13] Of the combined sample of 4,128 households, 2,799 households are in the plain region and 1,329 households are in the mountain region. We estimate equation (2) - the main DID model- separately for each outcome for plain regions and mountainous regions.

The results of this heterogeneity analysis are presented in Table 7. The percentage of respondents who reported good road conditions is higher in the mountain regions

[12]The mountain group included Diber, Gjirokastër, Korçë, Kukës, and Shkodër and the plain group included Berat, Durrës, Fier, Elbasan, Lezhe, Tirane, Vlorë.

[13]Some regions have plain as well as hilly and mountain, but for the classification purposes relief of the largest percentage of land in the region was considered. For example, if 60% of the land in Tirane is plain and 20% each is hilly and mountainous then Tirane is included as plain because the maximum area is plain in Tirane.

than in the plain regions. The impact of SLRP on road conditions is approximately three times greater in mountain regions (63.7 percentage points) than in plain regions (23 percentage points). The estimated impact on the price of residential and farmland is positive and overall statistically significant, but the benefits are concentrated mainly in the plain region. The effect of price on residential land is positive and significant only in the plain regions. In contrast, the effect of price on farmland is positive in both regions, but the effect is larger in plain regions compared to mountain regions. For food expenditures, households in the mountain region have an estimated impact of -1,863 Lekë, which is significant at the 5 percent level. The sign of the impact is counterintuitive, and there is no evident channel that could explain the negative impacts of road improvements on food expenditure. The impact on non-food expenditure is more than 100% larger in the mountain regions than in the plain regions. The average impact in the mountain region is 5,477 Lekë, while it is 2,125 Lekë in the plain region.

8 Conclusion

This study estimates the impacts of the "Secondary and Local Roads Project" (SLRP) on both the economic and non-economic welfare of rural households in Albania. Using a DiD method, our findings provide compelling evidence of significant short-term benefits from improved road infrastructure in rural areas. The results show a 35 pp increase in the quality of roads in communities benefiting from the SLRP project compared to control communities. This impact is particularly pronounced in mountain regions, where the positive rating of road quality increased by 64 pp.

We further examine the impact of the SLRP on key developmental outcomes, including land prices, home values, commuting time, and the employment status of household heads. In treated communities, residential and farmland prices, as reported by respondents, increased. In addition, household heads were less likely to be unemployed, with

self-employment becoming more common in these areas. Commuting times also decreased. In particular, the employment effects of the improved roads were substantial, suggesting that households in treated communities are transitioning from paid employment to self-employment, likely due to improved economic opportunities resulting from better connectivity. Although the study did not find a direct impact on household income, consumption expenditures showed a positive response to SLRP projects.

One of the most important findings of the study is the increase in the values of residential and agricultural land in the treated areas. Improved road access increased land demand, leading to higher prices for residential plots and farmland. This is consistent with the findings of similar studies in other developing countries, where road investments led to higher property values and economic activity. The rise in land values indicates that the project had a lasting economic impact on rural communities, making land ownership more valuable and potentially fostering long-term wealth accumulation.

Despite these positive outcomes, the study found no statistically significant effect of SLRP on household income. This aligns with previous research suggesting that infrastructure improvements alone may not immediately translate into higher household incomes, particularly in the short term. Although the project improved access to markets and services, it may take more time for these changes to manifest themselves as tangible income gains. However, there was a positive impact on household consumption expenditures, particularly for non-food items, suggesting that improved connectivity allowed households to access a wider range of goods and services, enhancing their overall standard of living.

The analysis also highlights the importance of considering regional variations when assessing the impacts of infrastructure projects. The benefits of SLRP were more pronounced in plain regions compared to mountain areas, especially in terms of land value appreciation. This suggests that while road improvements can provide benefits in different terrains, the extent of these benefits can vary depending on the specific characteristics of the region, such as topography and market access. We also note one limitation of the

study— due to a lack of data, we are unable to test for parallel trend, which is a crucial assumption for the validity of the DiD results.

Overall, the SLRP has made meaningful contributions to rural development in Albania. The project not only has improved the physical infrastructure but has also provided a foundation for improved economic activities and household welfare. However, the findings also underscore the need for complementary support mechanisms. Based on these findings, we recommend that future rural infrastructure initiatives be paired with targeted interventions—such as access to microcredit, vocational and entrepreneurship training, and programs that link rural producers to urban markets—to unlock the full economic potential of improved connectivity. Additionally, prioritizing road investments in regions where baseline travel times are high and market access is low—particularly in mountainous areas—may yield higher marginal benefits. Lastly, improvements in road infrastructure should be integrated within broader rural development strategies that include investments in education, health, and digital infrastructure to enhance long-term welfare outcomes. These recommendations can help policymakers design more holistic rural development programs that ensure inclusive and sustained economic gains from infrastructure investments.

8.1 Declaration

During the preparation of this work, the author(s) used "ChatGPT" in order to improve the language and avoid grammatical mistakes. After using ChatGPT, we reviewed and edited the content as needed, and we take full responsibility for the content of the publication.

Data availability: The dataset used in the analysis can be made available upon request.

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Table 1: Descriptive Statistics - Household, Household Head, Assets, and Income

	All Households (1)	Control (2)	Treatment (3)	Difference (Treatment-Control) (4)
Panel A: Household				
Age	37.05	36.13	38.03	1.90**
Gender (male)	52.28	52.60	51.96	-0.006
Married (age $>$ 25)	82.21	82.36	82.07	-0.002
Literacy (age $>$ 10)	97.13	96.92	97.35	0.004
Household size	3.92	3.96	3.87	0.09
Number of adults (age $>$ 16)	3.09	3.05	3.13	-0.08
Number of children (age $\leq$ 16)	0.83	0.91	0.73	-0.17***
Average days worked by adults with jobs in the past	4.13	3.39	4.98	1.58***
Panel B: Household Head				
Age	54.25	53.11	55.59	2.47***
% Female	6.25	6.69	5.72	-0.97
% Married	89.27	88.58	90.08	1.5
% Literate	94.30	93.20	95.59	2.38**
% Unemployed	41.65	46.09	36.52	-9.56***
Days worked in last month if employed	23.48	23.11	23.80	0.69
Cash income past month, Head	33,379.67	29,979.91	37,348.57	7,368.66
Distance from home to work	5.38	6.03	4.76	-1.26
Commute cost from home to work	259.60	282.97	233.59	-49.33
Travel time to work (minutes)	26.74	32.91	20.78	-12.12***

Notes: Differences at the 10, 5, and 1 percent level signified by *, **, ***, respectively. Monetary values in Lekë, distance values in kilometers, area values in square meters and time values in minutes.

	All Households (1)	Control (2)	Treatment (3)	Difference (Treatment-Control) (4)
Panel C: Household Assets				
Value of residence (including land)	3.7	2.32	5.06	2.74***
% Own other residential plot in commune	8.3	6.9	10.02	3.04**
Area of residential plots owned	652.91	566.35	752.03	185.68*
Average price of residential plot in the commune (Lekë per 100 sq meter)	0.37	0.19	0.51	0.31***
Panel D: Income				
Cash income past month, household	48,981.65	45,140.92	53,465.31	8,324.38
Net non-wage non-crop income, annual (i+ii+iii+iv)	197,630.3	174,589.7	224,528	49,938.35***
(i) Non-crop agricultural income (e.g. livestock)	40,303.6	48,652.8	30,556.8	-18,095.9***
(ii) Net business income	27,695.5	12,341.3	45,620.1	33,278.8***
(iii) Net rent income	253.73	389	95.8	-293.19
(iv) Net other income (pensions, etc.)	129,377.4	113,206.5	148,255.2	35,048

Notes: Differences at the 10, 5, and 1 percent level signified by *, **, ***, respectively. Monetary values in Lekë, distance values in kilometers, area values in square meters and time values in minutes.

Table 2: Impact of SLRP on access and quality of the nearest road

	Good road condition	Distance to nearest nearest motorable road (km)	Travel time to nearest motorable road (minutes)
	(1)	(2)	(3)
SLRP*Year (2016)	0.351***	-2.10***	-9.61***
	(0.066)	(0.679)	(3.038)
SLRP	0.04	-0.75***	-5.07***
	(0.04)	(0.26)	(1.33)
Year (2016)	0.176***	2.46***	10.32***
	(0.037)	(0.62)	(2.61)
Constant	0.026	0.752***	11.24***
	(0.047)	(0.265)	(1.298)
Observations	4,128	3,654	3,773
R-squared	0.34	0.14	0.15

Notes: Robust standard errors, clustered by village, in parentheses. *** p< 0.01, ** p< 0.05, * p< 0.1. All models include region fixed-effects.

Table 3: Impact of SLRP on home and land value

	Current value of home (million Lekë)	Price of residential plot (million Lekë per 100 sq meter)	Price of farm land (Lekë per sq meter)
	(1)	(2)	(3)
SLRP*Year (2016)	0.70	0.29***	787.19***
	(0.84)	(0.07)	(298.0)
SLRP	2.33***	0.040**	449.18**
	(0.39)	(0.019)	(224.86)
Year (2016)	0.16	0.190***	101.30
	(0.29)	(0.041)	(115.23)
Observations	2,746	2,238	2,659
R-squared	0.10	0.37	0.09

Notes: Robust standard errors, clustered by village, in parentheses. *** p< 0.01, ** p< 0.05, * p< 0.1. Region fixed effects are included in all regression models.

Table 4: Impact of SLRP on access to work and income (Head of the household only)

	Travel time to work (in minutes) (1)	Unemployment (2)	Self - employment (3)	Monthly employment income (4)
SLRP*Year (2016)	-9.76***	-0.12***	0.13***	22.98
	(3.00)	(0.03)	(0.04)	(38.88)
SLRP	-1.51	0.035**	-0.034	-11.66
	(1.04)	(0.017)	(0.033)	(21.31)
Year (2016)	14.48***	0.42***	-0.24***	23.56
	(2.46)	(0.026)	(0.036)	(34.38)
Observations	1,871	3,724	2,860	2,058
R-squared	0.27	0.23	0.23	0.04

Notes: Robust standard errors, clustered by village, in parentheses. *** p< 0.01, ** p< 0.05, * p< 0.1. Col (1) adjusts for distance to work; Col (2)-(4) adjust for age and education of the head of the household. Berat is the reference region. Income in 1,000 Lekë.

Table 5: Impact of SLRP on annual household income

	Annual household income (1)	Monthly employment income (2)	Annual business income (3)
SLRP*Year (2016)	-47.56	8.69	-56.25
	(45.45)	(20.96)	(38.81)
SLRP	58.08*	-11.32	69.41**
	(33.13)	(17.74)	(27.96)
Year (2016)	24.74	-21.02	45.76**
	(34.02)	(20.21)	(21.39)
Observations	3,965	3,965	3,965
R-squared	0.11	0.06	0.10

Notes: Robust standard errors, clustered by village, in parentheses. *** p< 0.01, ** p< 0.05, * p< 0.1. Berat is the reference region. All models adjust for number of adult members in the household, age, and education, and employment status of the household head. Income in 1,000 Lekë.

Table 6: Impact of SLRP on per capita consumption expenditure

	Monthly food expenditure (1)	Monthly non-food expenditure (2)	Monthly total expenditure (3)
SLRP*Year (2016)	80.39	2,843.37**	2,878.77*
	(569.69)	(1,169.90)	(1,462.37)
SLRP	547.94	84.23	635.02
	(339.04)	(602.64)	(798.34)
Year (2016)	2,624.70***	709.78	3,871.05***
	(345.70)	(592.26)	(891.17)
Observations	4,095	4,122	4,095
R-squared	0.08	0.02	0.04

Notes: Robust standard errors, clustered by village, in parentheses. *** p< 0.01, ** p< 0.05, * p< 0.1. Berat is the reference region.

Table 7: Heterogeneous effects

	Full sample (1)	Plain (2)	Mountain (3)
Good road condition	0.351***	0.230**	0.637***
	(0.066)	(0.087)	(0.083)
Price of residential plot	0.29***	0.41***	0.086
(million Lekë per 100 sq meter)	(0.071)	(0.09)	(0.10)
Price of farmland	787.19***	871.61**	691.26***
(Lekë per sq meter)	(298.0)	(425.17)	(201.48)
Livestock ownership	-0.071**	-0.095**	-0.001
	(0.033)	(0.045)	(0.04)
Monthly per capita	80.39	986.02	-1,863.7**
food expenditure	(569.69)	(695.69)	(885.92)
Annual per capita	2,843.37**	2,125.11*	5,477.9*
non-food expenditure	(1,169.90)	(1,147.9)	(3,181.2)
Per capita total	2,878.77**	2,735.69*	4,345.7
consumption expenditure	(1,462.37)	(1,580.08)	(3,701.83)

Notes: Robust standard errors, clustered by village, in parentheses. *** p< 0.01, ** p< 0.05, * p< 0.1. Berat is the reference region. All regressions include region fixed effects.

Appendix

Table A1: List of treated and control road segments

No.	Region	Communes	Name of road	No. of Villages
Treated road segments				
1	Gjirokaster (Permet)	Suke, Ballaban	Kelcyre - Suke - Ballaban	3
2	Kukes	Zapod, Shishtavec	Kukes - Shishtavec	5
3	Vlore	Kote, Sevaster	Kote - Sevaster	4
4	Fier	Frakull	Meto Asim - Kafaraj	4
5	Korce (Devoll)	Qender Bilisht, Miras	BilishtMiras	4
6	Elbasan (Gramsh)	Kodovjat	Gramsh - Kodovjat	4
7	Shkoder	Bushat	Fshat I Ri - Mal I Jushit - Hoten - Kukel	3
	Malesi e Madhe	Kelmend, Kastrat	Hani I Hotit - Tamare	4
8	Berat	Poshnje, Kutalli	Kutalli - Gorican - Kuc	4
	Berat	Velabisht, Roshnik	Duhanas - Roshnik	5
9	Tirane	Dajt, Shengjergj	Shkalle - Shengjergj	6
	Tirane	Komuna Dajt	Uzina e traktoreve - Lanabregas	3
10	Lezhe / Diber	Kthjelle, Rukaj	Rreshen - Urake	6
	Lezhe	Shengjin	Shengjin - Kune	3
11	Durres	Rrashbull, Katund I ri	Shenvlash, Kryqezim Fllake, katund I Ri	4
	Durres	Shijak, Gjepalaj, Maminas	Shijak - Gjepalaj	5
Control road segments				
1	Gjirokaster	Qender Libohove, Pogon	Kthesa Libohove - Suhe	3
2	Kukes	Surroj, Arren	Fushe Dukagjin - Qafe Komi - Arren	5
3	Diber	Selishte, Muhur	Vig - Ura e Varoshit - Muhur	5
		Luzni, Qender Tomin	Katund I ri - Lishan I poshtem	5
4	Vlore	Kote, Vllahine	Kote - Amonice - Vllahine	4
5	Fier (Mallakaster)	Selite, Aranitas	Selite - Aranitas	4
6	Korce	Lekëas	Voskopoje - Lekëas	4
7	Elbasan (Gramsh)	Kukur	Lilaj - Gribe; Antena Vodafon - Sojnik	4
8	Shkoder (Puke)	Qafe mali, Rrape	Degezim Berdhet - Lumbardhe - Qafe Bari	4
	Puke	Gjegjan	Degezimi Rruge (Tuneli) - Kimez - Qafe Lisi	3
9	Berat	Terpan	Kthesa Drobonik - Terpan	4
	(Skrapar)	Q. Skrapar, Potom	Zogas - Potom	5
10	Tirane	Zallbastar	Uzina e artlerise - Zallbastar	6
	Tirane	Zall-Herr	Zall-Herr - Herraj	3
11	Lezhe (Mirdite)	Fan	Shtrungaj - Klos - Thirre	6
	(Kurbin)	Milot	Rruga nacionale - Gallate - Vinjoll	3
12	Durres (Kruje)	Nikel	Virjon - Mukje	4
	Kruje	Cudhi	Noje - Mafsheq - Sheze	5

Table A2: Attrition Sample

	The same HH interviewed 4/5 years ago	Replacement households (%)
Beneficiary	74.6%	25.4%
Non-Beneficiary	70.9%	29.1%

Figure A1: Road projects by ADF in the last 3 years

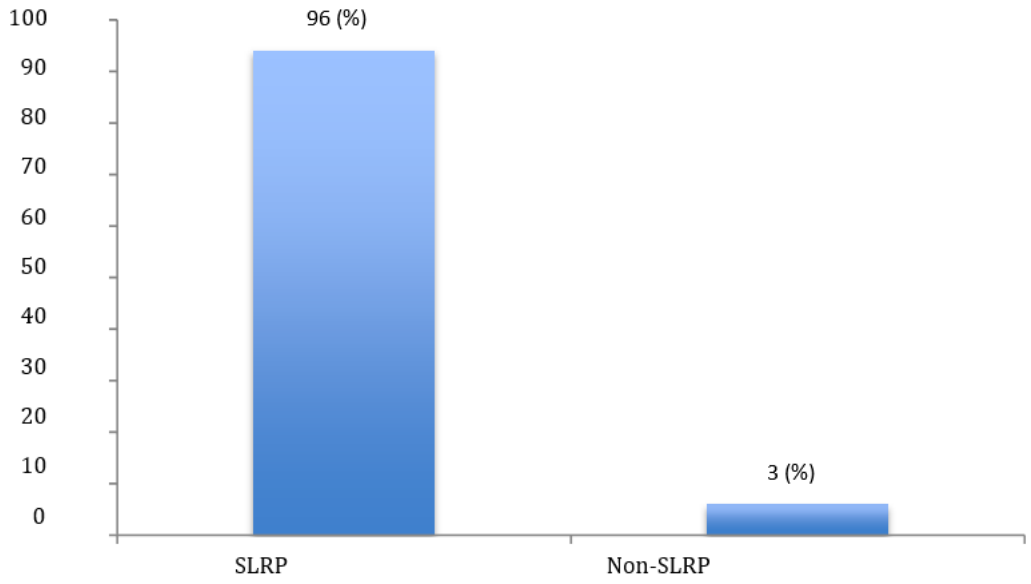

Table A3: Robustness check - Attrition analysis

	Not re-surveyed in endline (1)	Not re-surveyed in endline (2)
SLRP*Year (2016)	-0.042	
	(0.060)	
SLRP	-0.0001	0.035
	(0.015)	(0.049)
Year (2016)	0.539***	
	(0.042)	
Constant	-0.064**	0.600***
	(0.027)	(0.056)
Observations	4,082	1,968
R-squared	0.41	0.14

Notes: Robust standard errors, clustered by village, in parentheses. *** p< 0.01, ** p< 0.05, * p< 0.1. Both models include region fixed effects. Analysis in column (1) uses baseline and endline data both, while column (2) uses endline data only.