The Endogenous Returns to Infrastructure:
Social Institutions and the Choice of Development Paths[*]

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Abstract

Infrastructure investments generate widely varying returns across rural communities, yet the sources of this heterogeneity remain poorly understood. This paper argues that the definition of "effective infrastructure" is endogenous to the economic strategy that a community's social structure fosters. Using a triple-difference design that leverages the 1973 construction of the Namhae Bridge in Korea, I show that identical market access catalyzed two distinct, yet equally successful, development paths. Cohesive clan-based villages leveraged their capacity for collective action to modernize coordination-intensive rice production, achieving 21% productivity gains. Socially fractionalized villages, facing coordination challenges, instead pursued diversified portfolios of cash crops. Both strategies yielded comparable household income gains, though diversifying villages achieved superior population retention. These findings demonstrate that infrastructure creates value not through uniform mechanisms, but by relieving the specific constraints that bind each community's feasible development path.

1 Introduction

Infrastructure investments are central to development policy, yet their returns vary dramatically across seemingly similar communities. This paper shows that this heterogeneity emerges from a fundamental endogeneity: the effectiveness of infrastructure is conditioned by local social structures, which govern what economic strategies communities can pursue in response to new opportunities. Using the quasi-experimental construction of the Namhae Bridge in 1970s rural Korea, I show that identical infrastructure generates divergent development paths—with socially cohesive communities intensifying traditional production while fractionalized communities pivot to entirely new economic activities. Both paths led to comparable economic prosperity, revealing that infrastructure returns are not technological parameters but emerge from the interaction between physical and social capital.

Social fractionalization—divisions within society along dimensions such as race, ethnicity, and religion—raises coordination costs, impeding collective action (Alesina and La Ferrara 2002, Habyarimana et al. 2007, Moscona et al. 2017, Arbatlı et al. 2020). Yet, its effects may be more context-dependent than the literature suggests: when new opportunities arise, fractionalized communities may adapt by pursuing individualistic strategies that bypass coordination barriers. This nuance challenges the literature's focus on fractionalization's negative impacts—for instance, on public goods (Alesina and La Ferrara 2005), productivity (Hjort 2014), and growth (Montalvo and Reynal-Querol 2005)—and highlights how economic policies like infrastructure can interact with social structures to foster alternative development trajectories.

The Korean context provides a unique lens for this analysis. First, in the 1970s, rural Korea underwent a "miracle" with agricultural output per household rising 60% amid rapid industrialization. This growth stemmed from the decentralized *New Village Movement*, which empowered villages to prioritize local projects, creating variation in responses. Second, social fractionalization is cleanly measured by clan composition: Korean villages were organized around patrilineal kinship networks, with some homogeneous (up to 90% single clan) and others divided among competing clans. These structures influenced cooperation, such as labor-sharing in agriculture, without confounding ethnic or linguistic divides. Lastly,

the Namhae Bridge, completed in 1973, connected Korea's fourth-largest island (population 124,674 across 196 villages) to the mainland highway, reducing travel times to urban markets from days to hours. Driven by national priorities, the bridge's placement was exogenous to local traits, providing a natural experiment in market access.

To study these dynamic responses, I constructed the first village-level panel dataset on Korea's rural development, digitizing 336 volumes of administrative records from 1969–1984. This granular data covers agricultural outputs, inputs, investments, and socioeconomic outcomes for 196 villages in Namhae County.

The empirical strategy leverages triple-difference (DDD) estimates, comparing outcomes across time (pre/post-1973), bridge access (connected vs. unconnected islands), and social structure (above- vs. below-median clan fractionalization). This isolates the interaction effect while controlling for time-invariant village traits and island-wide shocks.

The results reveal institution-dependent adaptations. Cohesive, low fractionalization villages leveraged the bridge to modernize rice, a coordination-intensive traditional staple crop requiring synchronized irrigation, pest control, and harvesting. DDD estimates show they achieve 21.2% higher output per agricultural household (188 kg), widening their productivity advantage over fractionalized villages by 353 kg. Event studies confirm no pre-trends, with effects emerging 2–3 years post-bridge and peaking by 1977–1978 before attenuating.

A series of tests confirm that this gap reflects coordination failures rather than general agricultural capacity. First, the effect disappears entirely for barley, a low-coordination staple crop that households could farm individually without shared irrigation or synchronized planting, making it an ideal placebo. Second, the coordination penalty proves elastic to economic incentives: when either the benefits of coordination rise (proximity to bridge) or the costs of coordination fall (pre-existing roads reducing the need for new collective infrastructure), fractionalized villages overcome their disadvantage. Villages within 23.5 km of the bridge achieve rice productivity gains of 45 kg, and those with pre-existing roads gain 98 kg, effectively eliminating the 161-181 kg baseline penalty. This pattern, where identical villages perform differently based solely on the benefit-cost ratio of coordination, isolates organizational capacity as the binding constraint.

The coordination advantage manifests through two concrete channels: public goods pro-

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vision and technology adoption. Cohesive villages leveraged their coordination capacity to build feeder roads following the bridge construction, while fractionalized villages—where such projects would require land donations from multiple clans—saw significantly lower investment levels. Following the bridge construction, road investments diverged sharply between village types, even though overall project spending showed no difference across village types. These roads, in turn, facilitated technology adoption: the shift from organic manure use to chemical fertilizers and the uptake of power tillers. Bridge access alone reduced organic manure use by 7.41 kg in cohesive villages versus only 3.31 kg in fractionalized ones, a 56% smaller effect. The effect was driven by feeder road construction: about half of the bridge effect could be explained by villages that additionally built feeder roads. The power tiller adoption followed a similar pattern. Bridge access increased adoption by 2.6 per 100 households, with each additional road kilometer amplifying this effect by 23%. Thus coordination capacity determined which villages could build complementary infrastructure, which in turn shaped their ability to adopt productivity-enhancing technologies.

On the other hand, fractionalized villages pivoted to an individualistic strategy: agricultural diversification. They expanded special-use crop cultivation by 39 log points—2.5 times the rate of cohesive villages—and added nearly one additional crop variety per village. This was not random experimentation but strategic adaptation to their institutional constraints.

The crop-level patterns reveal their logic. Fractionalized villages drove the expansion in cabbage (increasing output by 0.38 tons per household, a 271% rise), capitalizing on how the bridge solved this perishable crop's key constraint—the risk of local market saturation. They similarly dominated silk production (+0.52 log points), exploiting stable government procurement that required little local coordination. Meanwhile, both village types equally abandoned subsistence potatoes, confirming that when opportunities improved for everyone, all adapted, albeit through different channels.

Remarkably, this alternative path proved equally successful. Fractionalized villages with bridge access reversed rural Korea's depopulation trend, achieving +3% population growth while cohesive villages continued declining at -7%. Household incomes followed a similar pattern, with fractionalized villages eliminating their traditional income penalty. These gains reflected genuine economic adaptation rather than differential access to information or re-

sources; livestock ownership and media access evolved identically across village types.

The evidence thus reveals how infrastructure catalyzed divergent but equally viable development strategies. Social structure did not determine success or failure but it dictated the path communities took to capture new opportunities.

The results contribute to three literatures. First, I advance the infrastructure and development literature by demonstrating that returns depend not on infrastructure per se but on the alignment between physical capital and local organizational capacity. This explains the mixed findings in prior work and suggests why place-based policies generate heterogeneous outcomes.[1] Second, I contribute to understanding how culture shapes economic responses to policy. Rather than cultural persistence constraining development, I show how communities leverage their specific institutional endowments—whether collectivist or individualist—to capture gains from new opportunities.[2] Third, by providing the first systematic analysis of Korea's landmark *New Village Movement*, I shed light on the mechanisms behind the country's rural development miracle, where agricultural productivity grew 60% during rapid industrialization.[3] This agricultural transformation, achieved through the localized adaptations documented here, freed labor for urban migration while maintaining rural output. This demonstrates how agricultural and industrial development can be complements in structural transformation.

Broadly, successful policy requires matching infrastructure investments to local institutional realities. Standard cost-benefit analyses that assume homogeneous treatment effects

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[1]See Khandker and Koolwal (2011), Brooks and Donovan (2020), Sotelo (2020), Shamdasani (2021), Gebresilasse (2023) for positive effects and Asher and Novosad (2020), Faber (2014) for limited impacts on socioeconomic outcomes. These mixed findings extend beyond rural roads. See Donaldson (2018) and Donaldson and Hornbeck (2016) for railways, Duflo and Pande (2007) for dams, Dinkelman (2011) and Lipscomb et al. (2013) for electricity.

[2]For the long-term impacts of historical events and cultural practices on contemporary economic outcomes, see Dell (2010), Dippel (2014), Lowes et al. (2017), Dell et al. (2018), Bazzi et al. (2020), and Lowes and Montero (2021). See Bau (2021) and Banerjee et al. (2024) for how economic policies can change cultural practices. See Alesina et al. (1999), Miguel and Gugerty (2005), Burgess et al. (2015), Wimmer (2016), Soifer (2016) for how ethnic homogeneity impacts public goods provision. See Moscona et al. (2020), Bazzi and Gudgeon (2021) for how ethnic homogeneity affects conflicts. See Alesina and Giuliano (2014), Bertrand and Schoar (2006), Moscona et al. (2017) for the effects of family ties and kinship structure on economic outcomes.

[3]For the literature on decentralization and service delivery, see Bardhan and Mookherjee (2006), Alatas et al. (2012), Cruz et al. (2020), Seidel (2023). The *New Village Movement*, a significant decentralized rural development program during this period, bears resemblance to contemporary community-driven development (CDD) programs, which have been studied in multiple settings with mixed results (Barron et al. 2006, Casey et al. 2012, Casey 2018, White et al. 2018).

will systematically misallocate resources. Instead, optimal infrastructure design depends on understanding which constraints bind for different communities and how physical capital interacts with existing social capital. As developing countries scale infrastructure, recognizing these complementarities seems imperative for inclusive growth.

2   Background

The 1970s transformation of rural Korea offers an ideal setting to examine how social structure mediates infrastructure returns. First, this era featured major transport investments—including the 1973 Namhae Bridge that reduced travel times from days to hours—alongside the decentralized *New Village Movement* (NVM) that enabled communities to undertake local projects. Second, Korean villages varied markedly in social cohesion due to longstanding kinship structures, creating differences in collective action capacity amid emerging economic opportunities. This section establishes two facts: kinship-based fractionalization generated variation in organizational capacity, and infrastructure gains hinged on coordinated local investments, making social structures salient.

2.1   Kinship Structure and Village Organization

Korean villages organized around patrilineal kinship networks via the *bon-gwan* system, which pairs family names with ancestral origins (e.g., distinguishing Gyeongju Kims from Gimhae Kims). These networks facilitated labor sharing (*poomasi*), credit associations (*gye*), and collective agriculture practices that persisted through industrialization (Brandt 1971, Wade 1982, Deuchler 2015).

Kinship patterns produced substantial village-level variation. About one-third resembled historical "clan villages," founded by elite lineages in the 15th-17th centuries, where a single *bon-gwan* dominated, fostering strong collective traditions (National Institute of Korean History 2023). Others arose from mixed settlements, yielding fractionalized communities with weaker institutions and diverse activities.

In the 196 Namhae villages, fractionalization—measured as one minus the Herfindahl-Hirschman index of clan shares—varies widely. Bottom-quartile villages lack any clan exceed-

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ing 10% share, while top-quartile ones have a largest-clan share exceeding 32% on average, echoing clan villages. This translated to tangible differences: cohesive villages averaged 91% agricultural households versus 78% in fractionalized ones. Unlike typical ethnic fractionalization measures as in Alesina and La Ferrara (2002), this variation avoids confounds like linguistic or religious divides, providing a cleaner test of coordination effects. Rooted in pre-modern settlements, it offers variation for analyzing responses to new opportunities.[4]

2.2   Infrastructure Expansion and Decentralized Development

Two transformative changes reshaped rural Korea in the 1970s. First, major infrastructure investments improved market access: the Namhae Bridge (completed in 1973) connected Korea's fourth-largest island (population of 124,674) to the mainland highway, while the Namhae Expressway (also completed in 1973, 273 km) linked coastal cities. For Namhae villages, travel to Busan fell from 8-12 hours to 3 hours, with remote areas gaining most. Driven by national priorities, this provides plausibly exogenous variation in market access.

Second, the government launched the *New Village Movement* (NVM, 1971-1979), a nationwide program that combined central resources with local implementation. Villages received matching grants to pursue self-selected projects—feeder roads, irrigation systems, community facilities—through collective decision-making. Between 1971 and 1979, participating villages received annual grants ranging from KRW 300,000 to KRW 1 million (roughly $600 to $2,000 in 1975 dollars), depending on performance and project scope, with requirements for local contributions of labor and materials.

This decentralization amplified the role of collective action. While the bridge created new market opportunities, capturing these gains required complementary investments: feeder roads to connect to the main highway, storage facilities for commercial crops, and irrigation improvements for intensive cultivation. Villages had to coordinate land donations for roads, organize collective labor, and manage shared infrastructure, tasks that required overcoming free-rider problems.

Thus, similar opportunities and resources interacted with kinship-based capacity to shape

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[4]Appendix A.1 details clan village origins, its persistence, and a case study of clan composition's influence on rural development.

development trajectories. As results show, cohesive villages modernized rice production via coordination, while fractionalized ones diversified individually. This divergence offers an empirical test of whether fractionalization uniformly constrains development or facilitates alternative responses—key for infrastructure policy in diverse societies.

3   Data

I construct the first village-level panel dataset on rural Korean development, digitizing 336 volumes of archival records to track 196 villages from 1969-1979. The dataset combines four sources to measure agricultural productivity, infrastructure investments, technology adoption, demographic change, and pre-existing social structure through historical clan composition. This unique data effort was made possible by the convergence of rare circumstances in Namhae County: the 1978 standardization of village development records, the preservation of township archives, and access to colonial-era census data on kinship structures. Appendix A.2 provides further details on the data search and digitization process.

3.1   Data Sources and Coverage

Township Statistical Yearbooks (1969-1984)   provide annual village-level data on agricultural output, input use, demographics, and socioeconomic indicators. These official records, compiled by township offices for county reporting, constitute my primary source for productivity outcomes. Data availability varies over the period: coverage is comprehensive for the baseline year (1969) but narrows to 49 villages (25%) for the pre-bridge period (1970-1975). Availability then expands to all 196 villages from 1976 onward.

History of Our Village (1971-1979)   documents development projects undertaken during the *New Village Movement*. In 1978, village leaders compiled standardized records of all local projects, including budgets, labor contributions, and physical specifications (e.g., road dimensions). I located and digitized records from 120 villages (61%), preserved in village community centers. To address the concern that villages with surviving records are systematically different, I test for balance on key pre-treatment characteristics (Appendix Table

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A.22). While the two groups are balanced on most measures, villages with surviving records were, on average, larger, had a higher share of paddy fields, and were located closer to the future bridge site. These differences are modest in magnitudes. To account for these observable baseline differences, I include these variables as controls in the regression analyses. Lastly, while these books were not formally audited, cross-validation with official township records suggests high data quality: project specifications match where both sources exist.[5]

New Village Comprehensive Survey (1972)   provides baseline characteristics before bridge construction. This Ministry of Internal Affairs survey records initial infrastructure (road access, electricity), geographic features (topography, streams), and early collective action capacity measured through performance grades in cement utilization projects during the first year of the *New Village Movement.* The survey covers all 196 villages.[6]

1930 Census Appendix on Family Names   enables measurement of social fractionalization through village-level clan composition.[7] The census recorded all kinship groups (*bon-gwan*) comprising at least 10% of village households, revealing substantial variation: in Namhae County, 40 villages had a single dominant clan (>50% of households) while others showed no dominant lineage. Historical sources and fieldwork confirm that these kinship structures remained salient through the 1970s, a point I validate empirically below.

3.2   Sample Construction and Key Variables

I link villages across sources using official administrative codes and village names, with manual verification for ambiguous cases. The final analysis sample comprises an unbalanced panel of 196 villages over 11 years (1969-1979), with 1,364 village-year observations for the core productivity analysis. Missing data primarily affects early years.

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[5]See Appendix Figure A.5 for an example, which shows an official record card for a 1975 farm road project alongside the corresponding *History* entry with identical project specifications.

[6]I thank Hyunjoo Yang of Sogang University for providing this dataset. See Appendix Figure A.4 for an example page from this survey.

[7]I thank Hyunjoo Yang of Sogang University for providing this dataset.

Bridge Access. The key treatment variable is bridge access. Villages on the connected island (Namhae) experienced immediate market access improvements, while those on the unconnected island (Changsun) serve as controls. The median connected village lies 23.5 km from the bridge, with distances ranging from 1 to 52 km. To capture this heterogeneous treatment intensity, I use several complementary measures:

- **Overall Access** (I_i^{Bridge}): An indicator variable distinguishing villages on the newly connected Namhae Island from those on the adjacent, unconnected Changsun Island within the same county. This captures the average impact of gaining bridge/expressway access.

- **Proximity-Based Intensity** ($I_i^{Proximate}, -log(Dist_i^{Bridge})$): Within the connected Namhae Island, treatment intensity is proxied by proximity to the bridge. $I_i^{Proximate}$ is an indicator for villages located closer than the median walking distance (23.5 km) to the bridge. $-log(Dist_i^{Bridge})$ uses the continuous walking distance, where higher values indicate closer proximity to the bridge. Distances are calculated based on detailed 1970 road network matrices to reflect travel paths at the time (see Appendix A.2.2 for details).

- **Local Infrastructure-Based Intensity** ($I_i^{Roads}, -log(Dist_i^{Township})$): Treatment intensity is also proxied by factors influencing a village's ability to leverage the new bridge access. I_i^{Roads} is an indicator for whether a pre-existing local road network passed through the village in 1972. $-log(Dist_i^{Township})$ measures the walking distance to the nearest township office, which served as local administrative and market centers.

Social Fractionalization. Measuring social fractionalization is typically challenging because it encompasses multiple dimensions, such as religion, culture, ethnicity, and language that cannot easily be reduced to a single metric. However, in the context of rural 1970s Korea, social fractionalization can be reliably approximated by the composition of family clans (*bon-gwan*) within villages, as other dimensions of fractionalization were largely homogeneous. As detailed in Section 2: Background, these kinship groups, identified by family

name and regional origin, were historically significant and continued to shape social and economic interactions in rural communities during the study period.

To quantify the degree of social division within each village, I use two standard indices widely used in the literature on ethnic diversity and conflict: Fractionalization (F) and Polarization (P). These indices, theoretically motivated by Esteban, Mayoral and Ray (2012), capture different aspects of group dynamics within a population. F represents the probability that two randomly drawn individuals from a population belong to different groups, while P measures the extent to which the population is divided into relatively homogeneous and antagonistic groups. Formally, F and P are defined as follows:

- Fractionalization: $F_i = 1 - \sum_{c=1}^{N} s_{ic}^2$

- Polarization: $P_i = 4 \sum_{c=1}^{N} s_{ic}^2 (1 - s_{ic})$

where s_{ic} denote the share of households belonging to a family clan c in village i.

Interpreting Fractionalization in Namhae County. Figure 1a plots F against P for villages in Gyeongsangnam-do (South Gyeongsang Province), highlighting those in Namhae County—a subregion of the province—in green. Figure 1b shows the distributions of F and P for Namhae County villages. The F values in Namhae County are notably high compared to benchmarks in the broader literature, with a mean of 0.92 and a distribution skewed towards high values (Montalvo and Reynal-Querol 2005, Bazzi et al. 2019). This suggests that most villages have multiple clans, with even less fractionalized ones typically featuring a few clans with significant but not overwhelming shares.

These high F values also reflect a methodological factor. Clans are more finely categorized than broader groupings like ethnicity or religion commonly used in other studies, which naturally inflates F by increasing the likelihood that two randomly selected individuals belong to different groups.

Despite these measurement considerations, relative differences in F scores remain empirically relevant. To capture clan presence and dominance more directly, I complement F scores with two additional measures: the share of significant clans ($ClanShare_i$: combined

Figure 1: Fractionalization (F) and Polarization (P)
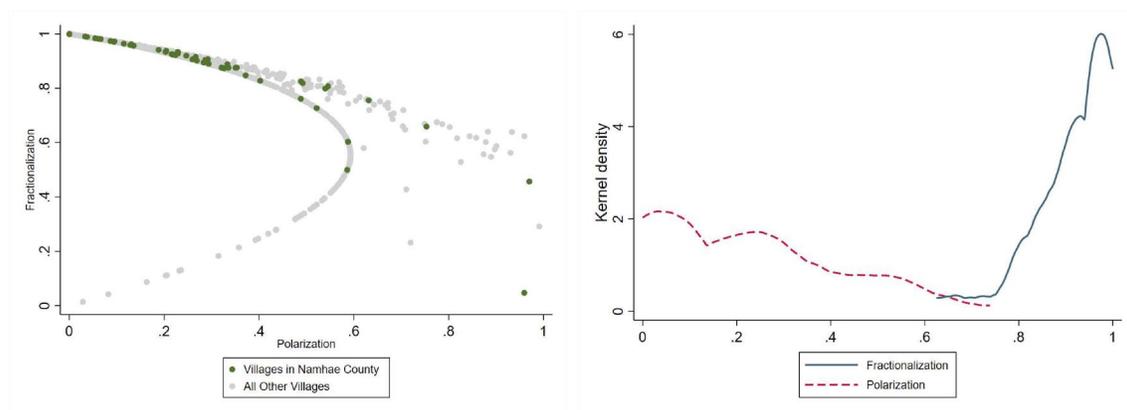
(a) Villages in Gyeongsangnam-do province (b) F and P Distributions in Namhae County

Notes: Figures are constructed using data from the 1930 Census, Family Names of the Korean Peninsula. Figure 1a plots F against P for all villages in Gyeongsangnam-do province. Each point represents a village, with villages in Namhae County, a part of this province, highlighted in green. Figure 1b shows the kernel density estimates of F and P for villages in Namhae County. The blue solid line represents the distribution of F, while the red dashed line represents the distribution of P. The kernel density estimation uses an Epanechnikov kernel with a rule-of-thumb bandwidth.

share of households in clans with $> 10\%$ representation; mean $= 0.25$, SD $= 0.16$) and top-share ($TopShare_i$: proportion of households in the largest single clan; mean $= 0.29$, SD $= 0.25$). For the main analysis, I use a binary indicator (I_i^{Frac}) equal to one for villages with above-median F values. Table 1 shows that less fractionalized villages have a significantly higher top clan share (0.32 vs. 0.06) than high-F villages. Most clans in high-F villages are small and fall below the 10% threshold, and were therefore not recorded in the 1930 census. On average, only 8% of households in these villages belong to significant clans, compared to 48% in less fractionalized ones, highlighting coordination challenges in the absence of dominant clans. This contrast supports using I_i^{Frac} and these metrics to capture social structure variations driving economic responses to the infrastructure shock.

Relevance and Persistence of Clan Networks. The primary data source for clan composition is the "Family Names of the Korean Peninsula," an appendix to the 1930 Japanese colonial census. It documented clans comprising more than 10% of a village's households. The key methodological challenge is establishing relevance across the 40-year interval to the 1970s study period. I address this using two pieces of evidence: the continued presence of

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Table 1: Clan Composition by Fractionalization Status in Namhae County

	$I_i^{Frac} = 0$ (Less Fractionalized)	$I_i^{Frac} = 1$ (Highly Fractionalized)	p-value
Fractionalization Index (F_i)	0.85	0.98	<0.01
Top Clan Share ($TopShare_i$)	0.32	0.06	<0.01
Significant Clan Share ($ClanShare_i$)	0.48	0.08	<0.01
Number of Villages	100	96	

Notes: This table compares clan composition metrics for villages below ($I_i^{Frac} = 0$) and above ($I_i^{Frac} = 1$) median fractionalization in Namhae County, using 1930 census data mapped to the 1970s. F_i is the Herfindahl-based fractionalization index. $TopShare_i$ is the share of households in the largest clan. Significant Clan Share ($ClanShare_i$) is the combined share of households in clans with $> 10\%$ representation (overall mean = 0.25, SD = 0.16). The 1930 census only reports clans with $> 10\%$ of households, so smaller clans (e.g., those in highly fractionalized villages with shares of 5-6%) are not counted as significant. p-values from t-tests of mean differences.

ancestral shrines (*jaesil*) for clans recorded in the 1930s, and the strong correlation between 1930s and 2000s clan composition.

First, ancestral shrines (*jaesil*) constructed between the 1970s and 1990s illustrate the enduring salience of clan affiliation in village life. These shrines, dedicated to clan ancestors, serve as focal points for ritual practices, community gatherings, and the reinforcement of clan identity and cohesion. Namhae County township history books (*myeonji*) written between 2004 and 2020 recorded the locations and origins of existing ancestral shrines in the county.[8] Between 1980 and 2000, there were 74 shrines constructed or substantially renovated. The investment in these physical markers of clan heritage underscores the continued centrality of kinship networks in organizing collective behavior and reinforcing shared norms.

To establish this connection directly, I mapped shrine-associated clans to those recorded as significant in 1930. Of 74 shrines, 65 (87%) were affiliated with clans that had significant presence in 1930. For example, the Jinyang Jeong clan, present across 10 villages in 1930, constructed five shrines across five townships after 1970. This correspondence demonstrates that clans maintaining ritual presence through shrine construction were predominantly the same clans that held demographic weight four decades earlier. While not all shrines map to county-wide dominant clans, their association with clans documented as village-level signifi-

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[8]These township history books were often compiled with substantial input from Mr. Eui-Yeon Jeong and Ms. Hee-Myung Ahn, who generously shared with me the full archive of Namhae data they had collected over several decades. Their contributions were instrumental in assembling the quantitative dataset and in contextualizing it through local historical narratives. The eight townships that made up Namhae County in the 1970s were subdivided into 10 townships in the 2000s: *Kohyun* (township history book published in 2004), *Nam* (2009), *Namhae* (2008), *Mijo* (2020), *Samdong* (2007), *Sangju* (2008), *Seo* (2007), *Seolchun* (2017), *Leedong* (2008), *Changsun* (2007).

cant in 1930 shows these kinship structures retained practical relevance rather than becoming historical relics.

Second, clan distributions from 2000s township history books provide direct evidence of persistence across the 20th century. All villages except twenty-eight semi-urban ones reported clan compositions at publication. Appendix Figure A.6a plots 1930 F-indices against 2000s counterparts, showing strong correlation ($\beta = 0.996$, SE = 0.16). Appendix Figure A.6b shows similar persistence for TopShare ($\beta = 0.703$, SE = 0.14). Despite seven decades spanning Japanese occupation, the Korean War, and rapid industrialization, clan structures show remarkable stability.

Mapping Historical Clan Data (1930) to the Study Period (1970s). Mapping the 1930 clan data to the study period requires several steps and assumptions, detailed further in Appendix A.3. First, since the 1930 census only provided township-level household counts, I estimated village-level counts by assuming that each village's share of its township's households remained constant between 1930 and 1972. Second, population growth led to village subdivisions: while there were 79 villages in 1930, this number increased to 196 by 1970. New villages typically emerged from subdivisions of existing ones, often retaining the parent name with a numerical suffix (e.g., Namhae-dong becoming Namhae-1-dong and Namhae-2-dong). For these cases, I assumed that both newly created villages inherited the clan composition of their 1930 parent village. Third, for the few clans that were spread across multiple villages in 1930, I allocated their households proportionally based on estimated 1930 village sizes.

The most critical assumption—that subdivided villages retained their parent village's composition—warrants careful scrutiny. If subdivisions reflected an influx of diverse newcomers into a specific area, the resulting villages could be more heterogeneous than their parent. Conversely, if divisions occurred along existing clan lines, homogeneity may have been preserved or even heightened. While available data cannot directly test these scenarios, empirical studies using Korean social security numbers mitigate concerns. Park (2018) and Rhee (2015) show that clan concentration generally increased in rural Korea during this period, as selective out-migration led marginal groups to leave first in search of new eco-

nomic opportunities. This suggests that assuming compositional stability may, if anything, understate clan homogeneity in the 1970s.

3.3   Descriptive Patterns

Appendix Table A.14 presents summary statistics for key variables. Three patterns warrant emphasis. First, despite population decline—from 689 to 566 residents per village between 1969-1979—rice output increased by 50%, representing the productivity puzzle this paper seeks to explain. Second, technology adoption proceeded slowly, with only 7% of agricultural households owning power tillers by 1979, suggesting mechanization alone cannot explain productivity gains. Third, development priorities shifted toward infrastructure, which rose from 52% to 72% of village project budgets during the decade.

Figure 2a presents a map of South Korea, highlighting the Namhae Expressway in orange and Namhae County within a red rectangle. Figure 2b shows Namhae County, which comprises two islands and eight townships further subdivided into 196 villages.

The resulting dataset provides unprecedented detail on village-level development during Korea's rural transformation. By combining productivity measures with pre-existing social structures and plausibly exogenous infrastructure timing, it enables the first causal analysis of how community organization mediates returns to market access.

4   Economic Implications of Baseline Sorting

To understand how the 1973 infrastructure shock differentially affected villages with varying social structures, I first examine systematic differences in baseline characteristics across levels of clan-based fractionalization. Villages with different fractionalization levels were not randomly distributed but had sorted along economic, geographic, and organizational dimensions that would shape their responses to improved market access.

Economic Orientation.   The most striking baseline differences between high and low fractionalization villages appear in their economic orientations. Table 2 reports baseline village characteristics. Less fractionalized villages ($I_i^{Frac} = 0$) were fundamentally agricultural com-

Figure 2: The Namhae Expressway, Namhae Bridge, and Namhae County
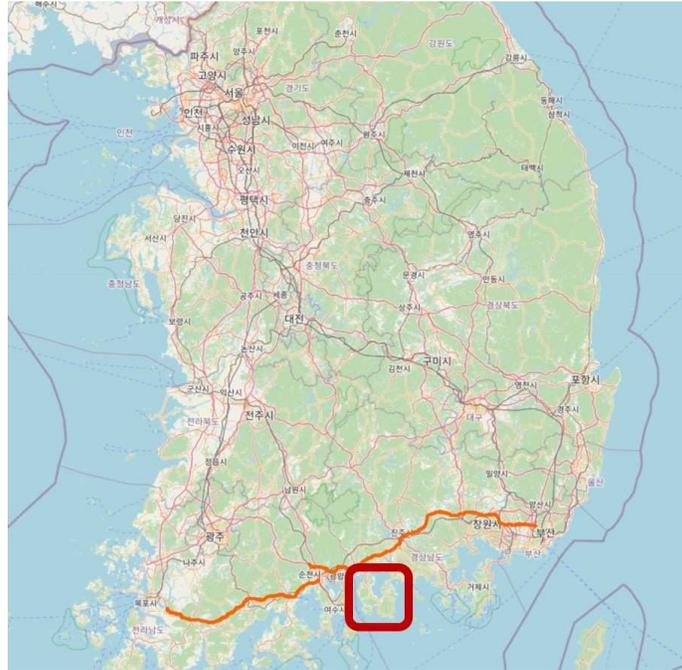
(a) The Namhae Expressway is highlighted in orange, and Namhae County is highlighted with the red rectangle.

(b) Namhae County and its eight townships
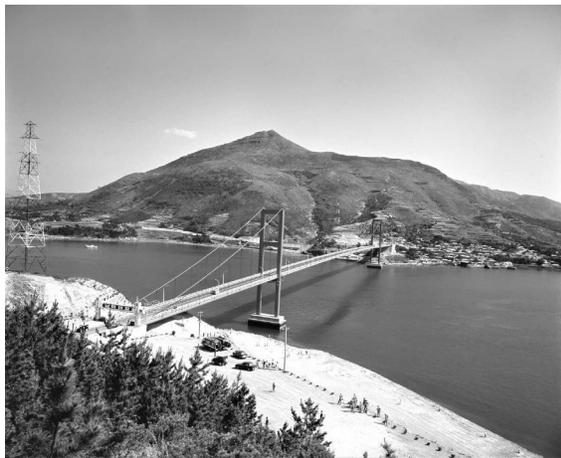
(c) The Namhae Bridge in 1973

munities: only 9% of households engaged in non-farm activities, compared to 22% in highly fractionalized villages. This agricultural orientation was reflected in land use, productivity, and complementary investments. They devoted 62% of arable land to rice paddies—six percentage points more than high-F villages—and achieved 17% higher rice productivity (921 kg vs 783 kg per agricultural household). This productivity advantage reflected both specialized land use and complementary investments: less fractionalized villages maintained 0.45 cows per household compared to 0.32 in highly fractionalized villages, with draft animals serving as important inputs for paddy cultivation.

These relationships remain robust after controlling for geography and administrative boundaries. Appendix Table A.15 Panel A shows that while basic geographic characteristics (land area, presence of streams, or mountainous terrain) appear unrelated to fractionalization, the share of land devoted to rice paddies is a strong negative predictor of a village being fractionalized. A 10 percentage point increase in a village's share of land dedicated to rice paddies is associated with a 7 percentage point decrease in its probability of being fractionalized, an economically meaningful difference particularly in the context of rice's central role in Korean agriculture. This relationship remains robust though slightly attenuated when township fixed effects are included in column (3). Correspondingly, Panel B shows that villages with a higher share of agricultural households are significantly less likely to be fractionalized after controlling for other demographic characteristics.

Appendix Table A.19 extends this analysis to specific agricultural outcomes. The rice output differential of -139.87 kg per agricultural household represents approximately 15% of the mean rice output, enough to feed 2-3 people at historical consumption rates. For livestock, their 5% lower cow ownership could determine whether households maintained independent plowing capacity or relied on neighbors. Special-use crop area is also 15% smaller, confirming systematically lower agricultural intensity. These specialization patterns align with coordination requirements in agriculture, particularly rice cultivation (Wade 1982).

Geography and Market Access. Geographic patterns reinforce this economic divergence. High fractionalization villages occupied peripheral positions in land-based networks: 45% farther from the county office (13.9 km vs. 9.6 km) with significantly worse county road

Table 2: Baseline Village Characteristics

	Kinship Fractionalization			Eventual Access to Bridge		
	$I_i^{Frac} = 0$	$I_i^{Frac} = 1$	p-value	$B_i = 0$	$B_i = 1$	p-value
Panel A: Demographics & Basic Infra. (1972)						
Population	646.1	732.6	0.05	804.7	670.7	0.04
Number of Households	106.5	123.9	0.04	124.4	113.6	0.39
Share of Non-Agricultural Households	0.09	0.22	0.00	0.24	0.14	0.00
Avg. Num. of Schools	0.17	0.27	0.12	0.19	0.22	0.74
Modern Roof Share	0.31	0.35	0.10	0.34	0.33	0.70
Panel B: Agricultural Prod. & Structure (1969)						
Rice Output per Agri. HH (kg)	921	783	0.01	880	849	0.71
Barley Output per Agri. HH (kg)	1251	1234	0.86	1741	1166	0.00
Rice Yield (kg/ha)	3177	3081	0.36	2763	3186	0.00
Special-use Crop Area (ha)	3.49	2.74	0.00	3.24	3.11	0.72
Number of Special-use Crops Grown	4.79	4.44	0.08	4.96	4.56	0.18
Share of Arable Land as Rice Paddies	0.62	0.56	0.00	0.48	0.60	0.00
Total Cultivated Area (ha)	46.9	43.9	0.29	54.8	44.0	0.01
Panel C: Livestock Assets (1969)						
Cows per HH	0.45	0.32	0.00	0.43	0.38	0.21
Pigs per HH	0.27	0.28	0.66	0.16	0.29	0.00
Chickens per HH	9.02	6.95	0.06	4.35	8.57	0.01
Rabbits per HH	0.33	0.24	0.02	0.18	0.30	0.04
Panel D: Amenities & Info. Access (1969)						
Radios per HH	0.31	0.30	0.70	0.40	0.29	0.06
Newspapers per HH	0.12	0.09	0.02	0.06	0.12	0.00
Share of Villages with Telephone Access	0.38	0.56	0.01	0.23	0.51	0.01
Panel E: Market Access (1972)						
Distance to the Bridge (km)	22.6	25.8	0.06	N/A	24.1	N/A
Share of Car Accessible Villages	0.79	0.72	0.26	0.65	0.77	0.21
Share of Highway Accessible Villages	0.22	0.19	0.57	N/A	0.24	N/A
Share of County Road Accessible Villages	0.55	0.35	0.01	0.54	0.44	0.36
Distance to Closest Admin Office (km)	4.44	6.12	0.06	4.15	5.43	0.33
Distance to County Office (km)	9.6	13.9	0.00	N/A	11.6	N/A
Panel F: Baseline NVM Indicators (1972)						
Share of Grade A Villages (initial assessment)	0.15	0.10	0.34	0.12	0.13	0.84
Initial Project Budget (USD)	1761	2205	0.40	1370	2024	0.43
Initial Voluntary Contributions (% of cost)	0.27	0.19	0.08	0.15	0.25	0.19
Initial Project Labor Input (worker-days per capita)	2.47	1.89	0.18	1.71	2.28	0.41

Notes: This table presents mean baseline characteristics of villages in Namhae County, grouped by kinship fractionalization and eventual bridge access. $I_i^{Frac} = 1$ indicates above-median fractionalization (lower clan concentration, based on the Herfindahl index). $B_i = 1$ indicates villages on the island connected by the 1973 Namhae Bridge. Columns 3 and 5 report p-values from t-tests comparing means across I_i^{Frac} and B_i groups, respectively. Panels A, C–F use 1972 data; Panel B uses 1969 data. Panels cover demographics and infrastructure (A), agricultural production (B), livestock assets (C), amenities and information access (D), market access (E), and New Village Movement (NVM) indicators (F). Korean Won values are converted to USD using an approximate exchange rate of 1,000 Won = 1 USD. Distances to the bridge and county office are unavailable for unconnected villages ($B_i = 0$). See Table A.21 for means by joint I_i^{Frac} and B_i categories.

access (35% vs. 55%), limiting their connections to traditional administrative and agricultural market centers. Appendix Tables A.16 and A.18 confirm that these patterns persist after controlling for village characteristics, village type, and township fixed effects.

However, high fractionalization villages compensated through maritime access. Appendix Table A.16 shows that high-F villages were closer to existing ports, and Appendix Table A.17 shows that they were 21 percentage points more likely to have port facilities within the village. Though no differences emerged for smaller-scale infrastructure like jetties, this proximity to larger port facilities suggests differential access to sea-based transport networks.

This geographic sorting—peripheral to land networks but proximate to sea routes—reflects adaptation to coordination constraints. Less fractionalized villages concentrated where collective agricultural investments yielded returns, while highly fractionalized villages located where individual economic activities remained viable. The 1973 bridge would thus encounter an already-differentiated landscape, with villages' geographic positions reflecting their underlying social capacities.

Collective Action and Initial Village Capacity. The economic and geographic differences documented above suggest underlying variation in collective action capacity. Though direct evidence is limited, villages' initial responses to the *New Village Movement* (1970-1979) offer suggestive insights. In 1970-71, prior to the movement's formal launch, the government distributed 335 bags of cement to every village in Korea with the requirement that they be used for public goods provision.[9] Based on how effectively villages used these resources, the government classified them into grades A, B, and C by 1972.[10]

During this initial phase, less fractionalized villages contributed 27% of project costs through voluntary labor and materials compared to 19% in more fractionalized ones. Though marginally significant, this eight-point difference is consistent with ethnographic accounts that dominant lineages served as focal points for mobilization in rural Korea (Deuchler 2015, National Institute of Korean History 2023). While the grade distributions in Namhae County show no significant differences by fractionalization, Yang (2019) finds that, across

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[9]This distribution originated from domestic cement oversupply rather than development planning, adding to its unexpected nature as a test of village capacity (Jwa 2018).

[10]The original labels were *Jarib* (independent), *Jajo* (self-help), and *Gicho* (basic). I follow Yang (2019) in translating these as A, B, and C, respectively.

5,539 villages in North Kyungsang Province, higher social heterogeneity is associated with lower initial grades. Taken together with their agricultural specialization and reliance on coordination-intensive rice farming, these findings suggest that less fractionalized villages benefited from organizational advantages rooted in their social structure—advantages that would prove crucial as new market opportunities emerged after 1973.

Implications for Infrastructure Impact. The 1973 infrastructure shock did not strike a blank slate. It encountered villages already sorted by their social structures into distinct economic and geographic niches. Less fractionalized communities had leveraged kinship networks to develop rice-based economies in suitable inland areas, while more fractionalized ones had adapted through diversification and coastal orientation.

This endogenous sorting means the bridge cannot generate uniform treatment effects. Instead, it would interact with existing capacities and constraints, potentially reinforcing agricultural advantages where coordination was strong, and opening new adaptive pathways where it was weak. The absence of differential pre-trends (Section 6) suggests villages were not on diverging trajectories before 1973, supporting the interpretation that post-bridge divergence stems from how new opportunities interacted with long-standing social structures. Whether these interactions enabled more fractionalized villages to overcome coordination barriers, or instead pushed them toward alternative development paths, forms the core empirical question.

5 Empirical Strategy

I exploit quasi-random variation in market access from the 1973 Namhae Bridge construction, interacted with pre-existing variation in village-level clan composition. The triple-difference design compares changes in outcomes across connected versus unconnected islands and high versus low fractionalization villages, identifying the differential effect of infrastructure on communities with varying collective action capacity.

5.1 Research Design

The primary identification challenge is isolating how pre-existing social structures mediate infrastructure impacts from confounding factors that correlate with both clan composition and economic outcomes. Villages with different fractionalization levels had sorted into distinct economic equilibria by 1973—less fractionalized villages specialized in coordination-intensive rice cultivation while more fractionalized ones diversified near coastal areas. This endogenous sorting precludes simple difference-in-differences approaches.

I address this through a triple-difference design that exploits the interaction between social structure and the market access shock. Consider first a standard difference-in-differences specification:

$$Y_{it} = \alpha_i + \lambda_t + \beta \cdot I_i^{Bridge} \cdot Post_t + \gamma X_{it} + \epsilon_{it} \tag{1}$$

This identifies the average effect of bridge access but cannot distinguish whether effects vary by social structure. The key insight is that the unconnected island provides a counterfactual for how villages with different social structures would have evolved absent the infrastructure shock. This motivates the triple-difference specification:

$$
\begin{aligned}
Y_{it} = \alpha_i + \lambda_t &+ \beta_1 \cdot I_i^{Bridge} \cdot I_i^{Frac} \cdot Post_t \\
&+ \beta_2 \cdot I_i^{Bridge} \cdot Post_t + \beta_3 \cdot I_i^{Frac} \cdot Post_t + \gamma X_{it} + \epsilon_{it}
\end{aligned}
\tag{2}
$$

where Y_{it} is rice output per agricultural household village i in year t; α_i and λ_t are village and year fixed effects; I_i^{Bridge} indicates villages on the connected island; I_i^{Frac} indicates above-median fractionalization; $Post_t$ equals 1 for years after 1973. Controls X_{it} include time-varying demographic variables—such as log population, average household size, and the share of women in the village population—as well as baseline village characteristics (agricultural share, population, land area, distance to township) interacted with year trends. Standard errors are clustered at the village level to account for serial correlation.

The coefficient β_1 identifies the differential effect of market access on highly fractionalized villages relative to less fractionalized ones. Importantly, β_3 absorbs any differential trends

between high and low fractionalization villages common to both islands, while β_2 captures the average bridge effect. This design requires only that the difference in outcome trajectories between high and low fractionalization villages would have been identical across islands absent the bridge, a weaker assumption than parallel trends for all groups.

5.2 Market Access Shock

The 1973 completion of the Namhae Bridge and concurrent Namhae Expressway (273 km) generated plausibly exogenous variation in market access. Prior to 1973, Namhae Island residents relied on ferry transport across the treacherous Noryang Strait, where powerful tidal currents made crossings unreliable and dangerous.[11] Travel to Busan, for instance, was reduced to just a few hours by bus from a trip that often required overnight stays.[12] This change sparked rapid expansion of local public transport; the number of buses operating on the island more than doubled within five years of the bridge opening (from 34 in 1973 to 76 in 1977). While the bridge itself may not be exceptionally large, its connection to the national expressway system integrated the island into Korea's broader economy.

The infrastructure's placement reflected national strategic priorities rather than local conditions. The challenging engineering requirements—necessitating a suspension bridge design with foreign technical assistance—and the expressway's provincial scope make village-level influence implausible. Within Namhae County, villages on the connected island (Namhae) gained immediate market access while those on the adjacent island (Changsun) remained accessible only by boat, providing clean treatment and control groups.

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[11] The Noryang Strait is historically significant as the site of the Battle of Noryang (1598), where Admiral Yi Sun-sin exploited the treacherous tidal currents to achieve victory in the final major naval engagement of the Imjin War. These same powerful currents posed significant engineering challenges for the Namhae Bridge project. Concerns that the intense flow could erode pier foundations required for conventional bridge designs led engineers to select a suspension bridge structure, which allows longer spans with fewer supporting piers in the water. Constructing the bridge over the challenging strait necessitated advanced technology and technical expertise sourced from Japanese firms with relevant experience.

[12] Historian Young Mi Kim of Kookmin University, who grew up in Namhae County, described her pre-bridge trips to Busan as "scary" and called being able to reach the city in a few hours by bus a "transformative event." She made this remark in her presentation titled *Characteristics of Collected Data on Namhae County's Saemaul Undong*, available on YouTube (channel: 인남해, uploaded June 22, 2019; accessed May 10, 2025).

5.3 Identifying Assumptions

Parallel Trends in Differences. The identifying assumption is that absent the bridge, the gap in outcomes between high and low fractionalization villages would have evolved identically in both islands. Formally:

$$\mathbb{E}[\Delta Y_{it}^H - \Delta Y_{it}^L \mid I_i^{Bridge} = 1] = \mathbb{E}[\Delta Y_{it}^H - \Delta Y_{it}^L \mid I_i^{Bridge} = 0] \tag{3}$$

where superscripts H and L denote high and low fractionalization villages.

This assumption is weaker than requiring parallel trends for all four groups separately. It allows for differential trends between islands (absorbed by β_2) and between fractionalization types (absorbed by β_3), requiring only that the interaction of these differences remains stable. Figure 4b validates this assumption by showing no differential pre-trends in the triple-difference coefficient for rice output. The pattern holds across multiple outcomes including rice yields (Appendix Figure A.9a), $TopShare$ (dominant clan share; Appendix Figure A.10a), and $ClanShare$ (combined share of significant clans; Appendix Figure A.10b).

Stable Unit Treatment Value Assumption (SUTVA). An important concern is spillovers between villages. The new bridge could induce migration, trade linkages, or knowledge transfers that violate SUTVA. Two complementary pieces of evidence suggest such violations are limited.

First, the treatment and control islands, while proximate within Namhae County, remained physically separated by water requiring boat transport. This geographic separation imposes transaction costs that limit economic integration. More importantly, if spillovers were substantial, we would expect to see changes in economic activity on the control island after 1973 as connected villages increased trade. The stability of outcomes on the unconnected island suggests limited cross-water spillovers.

Second, within-island spillovers would likely bias results toward zero. If, for example, the economic growth in newly-connected low-fractionalization villages created positive spillovers for nearby high-fractionalization villages, this would reduce the observed differential effect between them. Such spillovers would therefore attenuate, rather than artificially generate,

the main findings. Furthermore, the pattern of heterogeneous treatment effects provides a direct test: high-fractionalization villages show strong distance gradients to the bridge while low-fractionalization villages do not (Section 6). This asymmetry is consistent with a direct market access mechanism but is difficult to reconcile with a general spillover mechanisms, which should affect both types similarly.

Alternative Specifications and Robustness. The binary fractionalization and access measures, while transparent, potentially masks important heterogeneity. I pursue several extensions: (i) using continuous fractionalization index, F_i, (ii) alternative social structure measures, $TopShare_i$ and $ClanShare_i$, and (iii) heterogeneous treatment intensity, $-log(Dist_i^{Bridge})$ and $-log(Dist_i^{Township})$. Finally, to understand the full economic implications, I examine impacts across multiple channels—agricultural productivity, crop choice, technology adoption, public goods provision, and household welfare indicators.

Selection on Observables. Despite the quasi-random nature of infrastructure placement, endogenous village sorting remains a concern. I address this through increasingly demanding specifications: (i) Controlling for a rich set of baseline village and geographic characteristics leaves the coefficient largely unchanged, (ii) township-by-year fixed effects, exploiting within-township variation, yield similar estimates, (iii) implementing propensity score reweighting based on pre-treatment characteristics yields results consistent with the baseline estimates. As a further check, I re-estimate the model using only the covariates selected via LASSO, which produces similar results. Lastly, given the moderate number of clusters, I also implement wild cluster bootstrap inference (1,000 replications) following MacKinnon and Webb (2017).

6 Results

I begin by examining impacts on rice cultivation, the region's dominant crop characterized by high coordination requirements for irrigation, pest control, and harvest timing. Triple-difference estimates reveal that while cohesive villages successfully leveraged bridge access to intensify rice production, fractionalized villages, constrained by collective action problems,

experienced no such gains. This finding is sharpened by the fact that 1) the effect is absent for barley, a low-coordination crop, and that 2) the coordination penalty for rice is overcome when economic incentives are sufficiently high, as proxied by proximity to the bridge or the presence of complementary local infrastructure.

I then examine how fractionalized villages adapted to these coordination constraints. Using detailed crop-level data, I document a reallocation from rice to market-oriented alternatives requiring minimal collective action, with responses along both intensive (area) and extensive (variety) margins. The analysis shows that adoption patterns align predictably with the interaction between crop characteristics and available infrastructure: fractionalized villages disproportionately adopted crops where transport infrastructure addressed the primary logistical bottleneck, such as perishability.

I conclude by showing that this alternative development path generated comparable household income and exhibited greater population retention, despite broad rural to urban migration. This heterogeneous adaptation illustrates that when infrastructure mitigates market access constraints, the binding constraint shifts to an organizational one, inducing agents to optimize along different margins conditional on their institutional environment.

6.1 Rice Productivity

Motivation. Figure 3 shows substantial growth in rice productivity, measured as output per agricultural household, alongside emerging disparities by social structure. The left panel shows the village-level productivity distribution shifting rightward from 1969 (four years pre-bridge) to 1978 (five years post-bridge), with mean output rising 71% from 0.83 to 1.38 tons per household. This aggregate growth coincided with increased dispersion. The right panel decomposes the 1978 distribution by social structure, revealing that less fractionalized villages achieved higher mean productivity and lower variance than their more fractionalized counterparts. These patterns suggest that pre-existing social structures might play a role in shaping how villages respond to infrastructure-driven market access.

Figure 3: Rice Productivity Distributions in Namhae County Villages
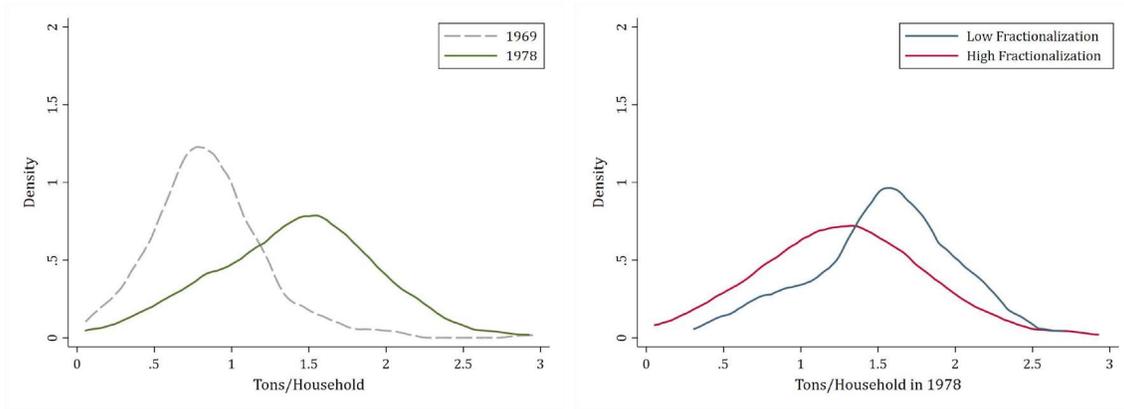
Notes: The left panel shows the distribution of rice output per agricultural household at the village level in 1969 and 1978. The right panel focuses on 1978 village-level productivity, comparing villages with different levels of pre-existing social fractionalization.

Triple-Difference Estimates. Table 3 formalizes this comparison. The bridge construction increased rice productivity by 188 kg (21% of the mean) in less fractionalized villages but slightly reduced it in highly fractionalized villages.

The double-difference specifications in columns 1-2 establish that neither bridge access nor social fractionalization alone significantly affected productivity. However, column 3's triple-difference specification uncovers the interaction between these factors.[13] The coefficient of -352.97 kg indicates that bridge construction widened the productivity gap between village types by 39% of pre-bridge mean output—an economically substantial effect.

The positive coefficient on $I_i^{Frac} \times Post_t$ (234.11 kg) provides important context: on the unconnected island, highly fractionalized villages were experiencing faster productivity growth than less fractionalized ones. Given their lower baseline productivity (783 kg vs. 921 kg, see Table 2), this trend likely reflects natural convergence as agricultural improvements during this period offered greater catch-up potential. The bridge disrupted this convergence—while less fractionalized villages leveraged market access to accelerate growth, highly fractionalized villages' gains were significantly more muted.[14]

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[13]Table A.31 reports the full regression results including all interaction terms and controls for demographic, socioeconomic, and geographic characteristics. The inclusion of these controls leaves the main coefficient virtually unchanged, moving from -349.7 to -357.1kg.

[14]$188.23 + 234.11 - 352.97 = 69.37kg$

Table 3: The Effect of Social Fractionalization on Rice Productivity

Panel A: Main Results

	Rice Output per Agri. HH (kg)		
	(1)	(2)	(3)
$I_i^{Bridge} \times Post_t$	9.79		188.23**
	(97.59)		(93.72)
$I_i^{Frac} \times Post_t$		-15.62	234.11**
		(51.06)	(113.29)
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$			-352.97***
			(127.68)
Demographic Controls	✓	✓	✓
Mean of Y (Pre-1973)	886.0	886.0	886.0
Observations	1,364	1,364	1,364
Number of Villages	196	196	196
R-squared	0.76	0.76	0.76

Panel B: Robustness of the Triple-Difference Estimates

	Baseline	PSW	Placebo
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$	-352.97***	-328.54**	-3.27
	(127.68)	(138.68)	(149.74)
Wild Cluster p-val	[0.009]		
Randomization p-val	{0.004}		

Notes: Panel A presents double-difference estimates (columns 1-2) and the main triple-difference specification (column 3). Panel B examines the robustness of the triple-difference coefficient using alternative approaches. All specifications include village and year fixed effects, and controls for demographic characteristics: log of total village population, average household size, and share of women in the village population. Wild cluster bootstrap p-values in brackets and randomization inference p-values in braces are based on 1,000 replications. PSW = Propensity Score Weighting. The mean standardized bias was reduced from 0.190 before weighting to 0.051 after weighting. Placebo = Pre-treatment placebo using 1971–1972 vs. 1969–1970. Standard errors clustered at the village level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Panel B validates these findings through multiple robustness tests. Propensity score weighting yields a similar coefficient, confirming results are not driven by observable differences between villages. Alternative inference procedures—wild cluster bootstrap (p = 0.009) and randomization inference (p = 0.004)—address concerns about the moderate number of clusters. Finally, a placebo test using only pre-treatment years produces a precisely estimated null effect (-3.27 kg), supporting the parallel trends assumption.

The robustness extends to alternative specifications and measures of social structure. Table 4 demonstrates stability across increasingly restrictive fixed effects. The coefficient attenuates from -353 to -251 kg (approximately 30%) when progressively adding controls for time-varying administrative shocks (column 2) and differential trends by initial conditions (columns 3-4). This pattern shows that while part of the baseline effect reflects differential trajectories based on villages' initial agricultural characteristics, approximately 70% of the impact remains even after accounting for these pre-existing differences. The persistence of a large, significant effect when allowing trends to vary by initial farmland area or agricultural household share rules out mechanical explanations based on village endowments—the bridges' impact on fragmented villages extends beyond simply connecting areas on different developmental paths. This robustness implies that any omitted variable would need to vary orthogonally across multiple dimensions (geography, administration, initial conditions, and measurement) to confound our results.

Table 5 demonstrates that our main finding is robust to alternative measures of village social structure. Since $TopShare_i$ and $ClanShare_i$ measure homogeneity rather than fractionalization, the positive coefficients confirm our interpretation: villages with greater clan concentration (i.e., less fractionalization) capture larger rice productivity gains from bridge access.

The effect is most precise when using the share of the single largest clan (280.53 kg, $p < 0.05$), suggesting that coordination capacity depends primarily on whether one group can mobilize collective action. The coefficient for combined significant clan shares remains positive and economically meaningful (227 kg) but loses statistical precision, indicating that multiple large clans may face coordination challenges even when they collectively dominate

Table 4: Robustness to Alternative Fixed Effects

| | Rice Output per Agricultural Household (kg) | | | |
	(1)	(2)	(3)	(4)
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$	-352.97***	-339.94***	-297.66**	-251.25**
	(127.68)	(125.99)	(128.16)	(127.19)
Fixed Effects:				
Village	✓	✓	✓	✓
Year	✓	✓	✓	✓
Township × Year		✓		
1969 Farmland Area × Year			✓	
1969 Share of Agri. HH. × Year				✓
Demographic Controls	✓	✓	✓	✓
Mean of Y (Pre-1973)	886.0	886.0	886.0	886.0
Observations	1,364	1,364	1,358	1,364
Number of Villages	196	196	196	196
R-squared	0.76	0.81	0.77	0.79

Notes: This table examines the stability of the triple-difference coefficient across alternative fixed effects specifications. All specifications include controls for demographic characteristics: log of total village population, average household size, and share of women in the village population. Column (1) includes only village and year fixed effects. Column (2) adds township × year fixed effects, absorbing time-varying shocks at the administrative level (25 villages per township on average). Column (3) adds farmland area × year fixed effects, allowing differential trends by initial agricultural capacity. Column (4) uses share of agricultural household in 1969 × year fixed effects, allowing trends to vary by initial specialization in agriculture. Standard errors clustered at the village level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

village demographics.[15]

Event Study Evidence. Figure 4 traces the dynamic effects of bridge construction on rice productivity, with the vertical dashed line marking 1973. Figure 4a estimates the average treatment effect across all villages (DD specification), and Figure 4b reveals heterogeneous impacts by clan composition (DDD specification). Both specifications show no evidence of differential pre-trends.

While the average bridge effect hovers near zero throughout (Figure 4a), decomposing by social structure uncovers substantial heterogeneity (Figure 4b). Highly fractionalized villages experienced significantly slower productivity growth following bridge construction—a

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[15]Additionally, these binary specifications appear to better capture the underlying relationship than continuous measures (Appendix Table A.20), where coefficients are directionally consistent but imprecisely estimated.

Table 5: Alternative Measures of Social Fractionalization

Social Structure Measures:	(1) Fractionalization I_i^{Frac}	(2) Top Clan Share $I_i^{TopShare}$	(3) Significant Clans Share $I_i^{ClanShare}$
Social Structure $\times I_i^{Bridge} \times Post_t$	-352.97***	280.53**	227.04
	(127.68)	(141.63)	(149.08)
Demographic Controls	✓	✓	✓
Village & Year FEs	✓	✓	✓
Mean of Y (Pre-1973)	886.0	886.0	886.0
Observations	1,364	1,364	1,364
Number of Villages	196	196	196
R-squared	0.76	0.76	0.76

Notes: The dependent variable is rice output per agricultural household measured in kg. Each column presents a triple-difference estimate using a different binary measure of social structure. Column (1) uses the baseline indicator, I_i^{Frac}, which equals 1 for villages with a above-median fractionalization. Column (2) uses an indicator, $I_i^{TopShare}$, which equals 1 for villages with a above-median share of the single largest clan (i.e., more homogeneous). Column (3) uses an indicator, $I_i^{ClanShare}$, which equals 1 for villages with a above-median combined share of all significant clans (those comprising more than 10% of households). Note that TopShare and ClanShare measure social homogeneity rather than fractionalization, so positive coefficients indicate that more homogeneous villages (higher clan concentration) benefit more from infrastructure, consistent with our main finding. Demographic controls include log of population, average household size, and share of women in the village population. Standard errors clustered at the village level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

gap that emerged with a 2-3 year lag and peaked around 1977-1978 before gradually attenuating. This delayed response aligns with the time required for agricultural investments and technology adoption to translate into measurable productivity gains.

The patterns prove robust across alternative specifications. Using rice yield (output per hectare) rather than output per household addresses potential compositional effects from agricultural sector entry/exit, yielding similar results (Figure A.9a). The findings hold with alternative social structure measures including $TopShare_i$ (dominant clan share, Figure A.10a) and $ClanShare_i$ (combined significant clan shares, Figure A.10b). Beyond clan-based measures, villages' 1972 performance grades—reflecting demonstrated collective action capacity following Korea's nationwide distribution of 335 cement bags per village—provide consistent results (Figure A.9b).

The temporary nature of the productivity gap warrants attention. Point estimates converge by 1979, with longer-term patterns confirmed in Figure A.8, suggesting that heterogeneous villages eventually caught up. The completion of the Changsun Bridge in 1980, which connected the smaller island to the main network, may have further accelerated this

Figure 4: Event Study of Bridge Impact on Rice Productivity
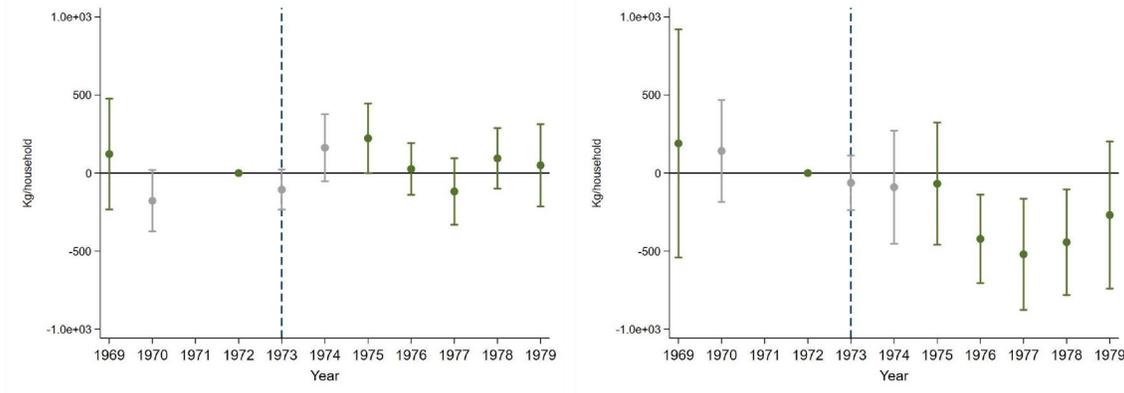
(a) The Bridge on Rice Productivity   (b) Heterogeneity by Clan Composition

Notes: These figures present event study estimates of the bridge's impact on rice productivity (kg per agricultural household). The vertical dashed line marks bridge construction (1973), with 1972 omitted as the baseline year. Figure 4a shows double-difference (DD) estimates comparing connected and unconnected islands. Figure 4b shows triple-difference (DDD) estimates, interacting bridge access with above-median social fractionalization. Grey markers indicate years with incomplete data coverage (only 49 of 196 villages reporting in 1970, 1973, and 1974). All specifications include village and year fixed effects. Points represent coefficients with 95% confidence intervals based on standard errors clustered at the village level.

convergence by expanding market access options.

These dynamics confirm that infrastructure returns depend on local social organization. The 350 kg differential—three months of household rice consumption—emerged gradually through cumulative differences in how villages leveraged new market opportunities. The following sections detail this coordination mechanism: first testing whether effects are unique to coordination-intensive rice production, then examining conditions under which even fractionalized villages can overcome these barriers, and finally exploring how constrained villages adapted through alternative economic strategies.

6.2 The Mechanism: From Social Cohesion to Public Goods and Technology

Evidence from Low-Coordination Agriculture. If social fractionalization constrains rice productivity through coordination failures, this effect should be absent for crops requiring minimal collective action. Barley, another staple crop in the region, provides an ideal test

Table 6: Effect of Social Fractionalization on Rice and Barley Productivity

	Rice Output per Agri. HH (kg) (1)	Barley Output per Agri. HH (kg) (2)
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$	-352.97***	-142.86
	(127.68)	(169.35)
Demographic Controls	✓	✓
Village and Year FEs	✓	✓
Mean of Y (Pre-1973)	886.0	1,208
Observations	1,364	1,286
Number of Villages	196	196
R-squared	0.76	0.49

Notes: This table presents triple-difference estimates for rice (column 1) and barley (column 2) output per agricultural household (kg). Specifications include village and year fixed effects and controls for log of village population, average household size, and share of women. Standard errors, clustered at the village level, are in parentheses. Double-difference results are reported in Appendix Table A.32 *** p<0.01, ** p<0.05, * p<0.10.

case: unlike rice cultivation which relies on synchronized planting to control pests and shared irrigation systems, barley farming is largely independent—households manage their own planting and harvesting schedules with minimal reliance on communal resources.

Table 6 presents triple-difference estimates comparing the bridge's impact on rice and barley productivity across villages with varying social fractionalization. Column 1 repeats the main findings in Table 3, showing a significant 39% productivity gap for rice (-352.97 kg) in high fractionalized villages. In contrast, column 2 reveals no such heterogeneity for barley: the triple-difference coefficient is small, less than half the rice effect in magnitude (-142.86 kg, 12% of mean barley output) and statistically insignificant. Appendix Table A.32 reports double-difference specifications, which confirm the null effect for barley.

The contrast between rice and barley underscores that social fractionalization constrains rice productivity through coordination failures. However, these barriers may be surmountable when the benefits of coordination are sufficiently high or the costs of collective action are reduced. The next subsection explores how treatment intensity—such as proximity to the bridge or access to local infrastructure—can lower coordination costs, enabling even fractionalized villages to overcome these constraints. I then examine how even fractionalized villages adapted through channels like technology adoption, public goods provision, and crop diversification.

When High Incentives Overcame Coordination Barriers. I examine whether high coordination benefits or low collective action costs reduce the impact of social fractionalization on rice productivity. I test this by studying how treatment intensity—measured by (1) proximity to the Namhae Bridge, (2) whether a government-maintained road passed through the village, and (3) distance to township offices, which served as hubs for markets, postal services, police, and administrative work—moderates this effect.

In the 1970s, with nearly all rural roads in Namhae County unpaved, walking distance to the bridge served as a proxy for market access intensity: villages farther away faced higher transportation costs. I estimate travel distances using distance matrices from the 1970 *Statistical Yearbook of Namhae County*, ensuring accuracy given the region's mountainous terrain.[16] To measure variation in coordination costs, I use two local infrastructure variables: an indicator for whether a national road (국도) passed through the village, and the log-transformed distance to the nearest township office, which served as administrative and service hubs.[17] I apply the same triple-difference framework, replacing the bridge access indicator with intensity measures: an indicator for villages closer than the median distance of 23.5 km to the bridge ($I_i^{Proximate}$), an indicator for villages with pre-existing roads in 1972 (I_i^{Roads}), and the negative log of distance to the nearest township office ($-\log(Dist_i^{Township})$). The sample is restricted to the 170 villages located on the connected island.

Table 7 reveals how market access intensity moderates the coordination penalty. While fractionalized villages typically lag by 161-181 kg per household (row 2), the interaction terms show this disadvantage disappears or reverses under favorable conditions. Proximity to the bridge yields a net gain of 45 kg for fractionalized villages (-181 + 226), pre-existing roads generate 98 kg (-161 + 260), and township proximity adds 26 kg (-121 + 147). These effects—reducing the fractionalization penalty by 60-125%—demonstrate that coordination barriers bind only when both benefits are low and costs are high.

Figure 5 presents nonparametric evidence of this relationship. Panel (a) shows productivity gains declining smoothly with distance for all connected villages. Panel (b) reveals the

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[16]See Appendix A.2.2 for details on the construction of the distance variable.

[17]The original record (*The 1972 New Village Comprehensive Survey*) distinguished among national, provincial, and municipal roads. I restrict attention to national roads, which were the only consistently paved and all-weather accessible routes in the early 1970s.

Table 7: Market access Intensity and Rice Productivity

	(1) Proximity to Bridge $I_i^{Proximate}$	(2) Pre-existing Roads I_i^{Roads}	(3) Proximity to Township $-log(Dist_i^{Township})$
$Intensity \times Post_t$	130.21**	-91.53	-102.90***
	(50.22)	(62.90)	(33.77)
$I_i^{Frac} \times Post_t$	-181.05***	-161.08***	119.19
	(53.80)	(50.42)	(114.99)
$Intensity \times Post_t \times I_i^{Frac}$	226.13**	259.54*	146.43**
	(91.83)	(132.75)	(57.57)
Demographic Controls	✓	✓	✓
Village and Year FEs	✓	✓	✓
Mean of Y (Pre-1973)	857.3	857.3	857.3
Observations	1,079	1,079	1,079
Number of Villages	170	170	170
R-squared	0.81	0.80	0.80

Notes: The dependent variable is rice output per agricultural household measured in kg. This table presents triple-difference estimates using market access intensity measures: proximity to the bridge ($I^{Proximate}i$, equal to 1 for villages within 23.5 km), presence of a national road in 1972 (I_i^{Roads}), and the negative log of distance to the nearest township office ($-\log(Dist_i^{Township})$). All regressions include village and year fixed effects, and control for the log of village population, average household size, and share of women. Standard errors, clustered at the village level, are reported in parentheses. Full specifications and robustness checks appear in Appendix Table A.33. *** p<0.01, ** p<0.05, * p<0.10.

heterogeneity by village type: while both village types benefit from proximity, fractionalized villages exhibit a markedly steeper distance gradient. Within approximately 20 km of the bridge, productivity differences between village types converge, suggesting that high returns to market access can indeed overcome coordination costs.

These findings indicate that coordination barriers are not insurmountable. When market access benefits are high (proximity to the bridge) or coordination costs are lowered (existing roads or township proximity), fractionalized villages can coordinate effectively—investing in irrigation or adopting technologies to boost rice productivity. While historical distance measures and binary infrastructure indicators might introduce measurement error, robustness checks across alternative fixed effects (Appendix Table A.33) confirm the consistency of the results.

The ability of fractionalized villages to overcome coordination barriers under favorable conditions raises the question of how these productivity gains are achieved. The next subsection examines the specific channels—technology adoption and public goods provision—

Figure 5: Nonparametric Estimates of Rice Productivity Growth by Distance to the Bridge

(a) Productivity Growth by Distance   (b) Estimation of Productivity by Homogeneity
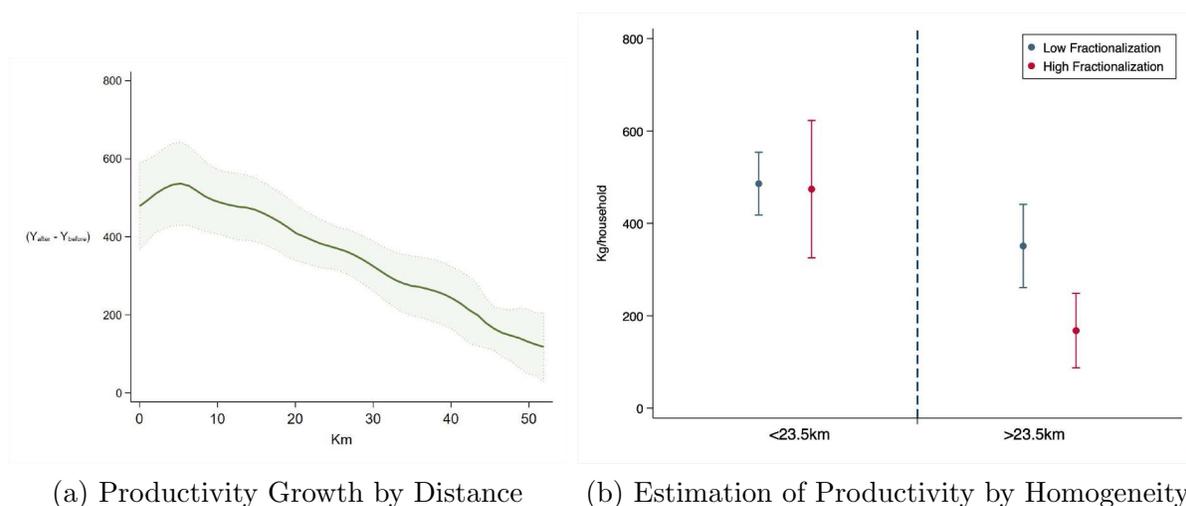
Notes: Panel 5a plots a local polynomial regression of the average productivity growth $(\bar{Y}_{before} - \bar{Y}_{after})$ on distance to the bridge. Panel 5b compares productivity gains by distance and social structure. For villages near (< 23.5 km) and far (> 23.5 km) from the bridge, bars show the estimated change in rice output per household after 1973, separately for low fractionalization and high fractionalization villages. The steeper decline for heterogeneous villages indicates that proximity matters more when coordination is challenging. Estimates use village fixed effects and clustered standard errors at the village level.

through which successful villages, both homogeneous and fractionalized, leverage market access to enhance rice productivity, setting the stage for exploring their divergent adaptation strategies.

The Coordination Bottleneck: Building Feeder Roads. The finding that incentives can override coordination failures suggests a deeper interaction between market access and local institutions. This section investigates the primary channel for this effect, proposing that the productivity gains were mediated by an endogenous investment in public goods: feeder roads.

Road construction was often the binding constraint to modernization. While the Namhae Bridge opened new economic opportunities, only socially cohesive villages could overcome the collective action problem of building the infrastructure needed to connect to it. This, in turn, unlocked subsequent private investments in new technologies. The *New Village Movement*, which subsidized material costs but mandated local coordination for labor and land, provides a clean empirical test of this mechanism. The divergent responses to this policy reveal how social cohesion became the prerequisite for pursuing a coordination-intensive growth path

Figure 6: The Role of Social Cohesion in Public Goods Investment

(a) Road Investment
(By Bridge Access)

(b) Road Investment
(By Fractionalization)

(c) All Project Investment
(By Fractionalization)
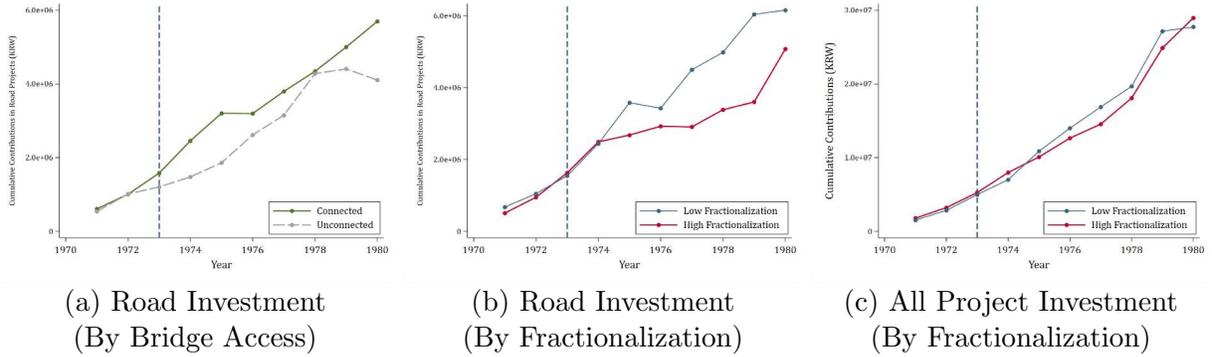
Notes: This figure plots the cumulative average contributions per village to public goods projects from 1971 to 1980. The vertical dashed line in each panel indicates the opening of the Namhae Bridge in late 1973. Panel (a) compares villages on the connected island to those on unconnected islands, showing a divergence in road investment after the bridge opened. Panels (b) and (c) restrict the sample to connected villages only. Panel (b) shows the divergence in road investment was driven by low-fractionalization (more socially cohesive) villages. Panel (c) serves as a placebo test, showing no systematic difference between high- and low-fractionalization villages in contributions to all village projects combined, suggesting the coordination problem was specific to road-building. Data are from digitized *History of Our Village* records.

based on modernizing rice agriculture.

Figure 6 illustrates the coordination challenges in road construction. Panel 6a shows that following the 1973 bridge construction, villages on the connected island spent more on road projects compared to unconnected villages, likely reflecting the greater returns to improving local networks. Panel 6b shows that this gap was driven by low-fractionalization villages: among connected villages, road investment trends were parallel until 1974, then sharply diverged as low-fractionalization villages accelerated investment. This divergence reflects the general holdout problems of fractionalized villages. Panel 6c provides a placebo test by examining contributions to all village projects combined. High- and low-fractionalization villages show no divergence in overall investment amounts throughout the period. It points to a coordination bottleneck uniquely acute to road projects, which require navigating the fragmented land ownership.[18]

The descriptive patterns are consistent with the formal econometric estimates. Event study estimates confirm that connected villages increased road investments after the bridge

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[18]Appendix A.1.3 illustrates this through a case where a clan-homogeneous village resolved land disputes and adopted technology years earlier than its fractionalized counterpart.

opened, with this effect concentrated in socially cohesive villages.[19] The convergence of evidence—from descriptive patterns to formal tests—establishes that coordination capacity determined which villages could build the feeder roads necessary to access new markets. This infrastructure bottleneck, in turn, shaped subsequent technology adoption patterns, as the next section demonstrates.

From Roads to Technology and Productivity. A key mechanism linking social cohesion to productivity was the construction of feeder roads, which proved essential for overcoming physical barriers to technology adoption. This section examines two transformative agricultural technologies: chemical fertilizers and power tillers. In the 1970s, poor rural roads made it difficult to transport chemical fertilizers reliably and restricted the use of power tillers. As a result, many villages remained locked into traditional, less productive farming methods that relied on locally-produced organic manure.

Table 8 demonstrates how bridge access catalyzed agricultural modernization through complementary road infrastructure. Bridge construction reduced organic manure use by 7.14 kg per agricultural household—a 43.8% decline from pre-bridge levels—indicating rapid substitution toward chemical fertilizers (Column 1). This modernization effect, however, was significantly weaker in socially fractionalized communities: villages with above-median clan fractionalization experienced a 4.10 kg smaller reduction, suggesting coordination barriers impeded the collective action required for complementary investments (Column 2). Column 3 reveals how local infrastructure amplifies market access benefits: while bridge access alone reduced organic manure use by 4.36 kg, villages that mobilized to build feeder roads achieved a total reduction of 8.01 kg, nearly doubling the effect. This illustrates that local complementary investments were necessary for large-scale infrastructure projects to fully translate into technological advancement.

A parallel mechanism governed power tiller adoption, though cross-sectional data require a cautious approach. Bridge access increased power tiller ownership by 2.6 per 100 agricul-

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[19]Appendix Figure A.11 presents difference-in-differences estimates showing the overall effect of bridge access on road construction. Appendix Figure A.12 presents triple-difference estimates examining heterogeneity by social fractionalization. While these estimates are imprecise due to the limited number of villages captured in the digitized *History of Our Village* records (122 out of 196 villages), the consistently negative coefficients align with the descriptive evidence.

Table 8: Road Infrastructure and Agricultural Modernization

	Organic Manure Use (kg per agri. HH)			Power Tillers (per agri. HH, avg. 1977-79)	
	(1) Baseline	(2) Fractionalization	(3) Road Building	(4) Baseline	(5) Road Stock
$I_i^{Bridge} \times Post_t$	-7.14*** (0.83)	-7.41*** (0.83)	-4.36*** (1.33)		
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$		4.10*** (0.73)			
$I_i^{Bridge} \times Post_t \times I_{i,t}^{BuiltRoads}$			-3.65** (1.70)		
I_i^{Bridge}				0.026** (0.011)	0.020** (0.009)
$I_i^{Bridge} \times I_i^{Frac}$				-0.019** (0.008)	
$I_i^{Bridge} \times RoadStock_{i,1977}$					0.013** (0.005)
Interpretation:					
Bridge effect (low frac.)	-7.14***	-7.41***		0.026**	
Bridge effect (high frac.)		-3.31***		0.007	
Bridge + Road effect			-8.01***		See note
Village and Year FEs	✓	✓	✓		
Controls				✓	✓
Observations	398	398	398	103	103
Number of Villages	83	83	83	103	103
R^2	0.73	0.73	0.73	0.13	0.13
Mean of Y (Pre-1973)	16.3	16.3	16.3		
Mean of Y (1977-79)				0.057	0.057

Notes: This table examines how road infrastructure facilitated agricultural modernization through technology adoption. *Panel A* (Columns 1-3): DiD estimates using organic manure use (kg per agricultural household) as dependent variable, 1970-1979. Declining manure use indicates substitution to chemical fertilizers. $I_{i,t}^{BuiltRoads} = 1$ if village i constructed feeder roads by year t. *Panel B* (Columns 4-5): Cross-sectional analysis of power tiller ownership per agricultural household (average 1977-79). $RoadStock_{i,1977}$ measures cumulative kilometers of feeder roads built through 1977 minus the sample mean of 2.27 km. $I_i^{Bridge} = 1$ if village received bridge access in 1973. $I_i^{Frac} = 1$ if clan fractionalization exceeds median. Controls in columns 4-5: car accessibility dummy (1972), share of modern roofs (1972), and log population (1972). Standard errors clustered at village level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Interpretation notes: Column 3: Combined effect calculated as -4.36 + (-3.65) = -8.01 for villages that built roads. Column 5: With re-centered road stock variable, the bridge effect at mean road stock is 0.020 (35% of mean power tiller ownership). Each additional kilometer of roads above the mean increases the bridge effect by 0.013, representing a 23% increase relative to mean ownership.

tural households, yet this benefit was weaker in high-fractionalization villages (Column 4). Column 5 highlights complementary infrastructure again: each additional kilometer of feeder roads above the mean amplified the bridge's impact by 1.3 tillers per 100 households. Given that the mean road stock was 2.27 km with substantial variation around it, villages with above-average road infrastructure saw considerably larger mechanization gains from bridge access.[20]

These findings come with important caveats: the analysis uses a panel dataset of 83 villages for organic manure use spanning 1970–1979, and cross-sectional data from 103 villages for tiller ownership, averaged over 1977–1979. Potential confounders are controlled by including baseline infrastructure (1972 car accessibility), economic status (share of modern roofs), and village size (log population). While panel data facilitate causal inference for fertilizer adoption, the cross-sectional tiller results must be interpreted as correlational. Nevertheless, the consistent patterns across both outcomes underscore how pre-existing social structure, by enabling provision of public goods like road infrastructure, could drive technological change and productivity.

6.3   Alternative Adaptation Paths and Economic Outcomes

The evidence thus far reveals that social fractionalization created a bottleneck, preventing certain villages from capitalizing on the new bridge through modernization of coordination-intensive rice production. While cohesive villages invested in feeder roads and adopted new technologies, fractionalized villages faced constraints on this collective path. This raises a question: how did these constrained communities adapt?

This section shows that fractionalized villages pivoted from collective agriculture to individualistic enterprise. By diversifying into cash crops, these communities achieved comparable gains in household income and assets. These findings illustrate that different configurations of social and physical infrastructure can generate divergent yet equally viable development trajectories.

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[20]The coefficient 0.020 represents the bridge effect at mean road stock (after re-centering). The interaction coefficient 0.013 shows how this effect increases with each additional kilometer above the mean.

Agricultural Diversification into Special-use Crops. While cohesive villages intensified rice production, fractionalized villages shifted toward crops requiring less collective action. Special-use crops and cash crops—particularly garlic, sweet potatoes, and raw silk in Namhae County—offered an attractive alternative.[21] These crops could be cultivated by individual households, making them viable where coordination proved difficult. This shift represents a rational response to institutional constraints: trading the high-coordination returns of modern rice farming for the autonomy of market-oriented production.

Table 9 documents this adaptive response across both intensive and extensive margins. Column 1 shows that bridge access, on average, increased special-use crop cultivation by 24 log points. However, this effect varied significantly by social structure. Column 2 shows that the effect was concentrated in fractionalized villages, which expanded their crop area by an additional 23 log points, relative to their cohesive counterparts. This brings the total effect for high-fractionalization village to 39 log points, nearly 2.5 times the effect in low-fractionalization villages. The extensive margin reveals a similar pattern: cohesive villages showed slight reduction in crop diversity (8%), but fractionalized villages added 0.95 new varieties on average (Column 5), a 21% increase from the pre-period mean.

The role of complementary infrastructure appears primarily through crop experimentation rather than area expansion. Each additional kilometer of feeder roads increased the number of cultivated varieties by 0.74 (Column 6), representing a 19% increase relative to baseline diversity. However, road infrastructure showed no significant effect on the intensive margin (Column 3). Roads might have lowered the fixed costs of trying new crops but did not necessarily make large-scale cultivation immediately more profitable. Note that these road results are based on a smaller subsample of villages with surviving village projects records; however, balance tests confirm no systematic selection (See Appendix Table A.22).

Strategic Crop Selection and Infrastructure Complementarities. The aggregate shift toward diversification is best understood by examining crop-level production decisions. I analyze how the bridge's impact varied across Namhae's key agricultural products: rice,

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[21]The Korean government separately tracked "special-use crops" (특용작물), including cotton, hemp, sesame, castor bean, perilla, sunflower, and medicinal roots like peony and balloon flower. Garlic and silk production were tracked separately as they were major sources of rural cash income.

Table 9: Bridge Access and Agricultural Diversification

	Intensive Margin: Log(Special-use Crop Area + 1)			Extensive Margin: Num. of Special-use Crop Varieties		
	(1) Baseline	(2) Frac.	(3) Road Stock	(4) Baseline	(5) Frac.	(6) Road Stock
$I_i^{Bridge} \times Post_t$	0.24*** (0.05)	0.16*** (0.04)	0.36 (0.26)	-0.00 (0.14)	-0.39** (0.16)	-0.49** (0.23)
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$		0.23** (0.10)			1.34*** (0.29)	
$I_i^{Bridge} \times Post_t \times RoadStock_{i,t}$			-0.06 (0.11)			0.74*** (0.24)
Interpretation:						
Net effect for high-frac. villages		0.39***			0.95***	
Net effect at mean road stock			0.26			0.72
Village and Year FEs	✓	✓	✓	✓	✓	✓
Log(Farmland$_{i,1972}$) × Year FE	✓	✓	✓	✓	✓	✓
Observations	989	989	479	937	937	453
Number of Villages	195	195	106	195	195	106
R-squared	0.51	0.52	0.55	0.67	0.69	0.76
Mean of Y (Pre-1973)	2.90 ha	2.90 ha	2.46 ha	4.42	4.42	3.73
Mean RoadStock$_{i,t}$ (km)			1.64			1.64

Notes: Triple-difference estimates examining how bridge access affects agricultural diversification into special-use crops, moderated by social fractionalization and complementary road infrastructure. The sample includes villages from 1970-1979. Columns 1-3 examine the intensive margin using log(hectares + 1) devoted to special-use crops. Columns 4-6 examine the extensive margin using the count of distinct special-use crop varieties cultivated. $I_i^{Bridge} = 1$ if village received bridge access in 1973. $Post_t = 1$ for years after 1973. $I_i^{Frac} = 1$ if clan fractionalization exceeds the median. $RoadStock_{i,t}$ measures cumulative kilometers of feeder roads constructed through year t. Sample size reduction in columns 3 and 6 reflects data availability: road construction records from *History of Our Village* survive for only 122 villages, with projects beginning in 1971. Not all villages with road data reported special-use crop cultivation, resulting in 106 villages. All specifications include village and year fixed effects, plus interactions between log(1972 farmland area) and year fixed effects to control for size-specific trends. Standard errors clustered at village level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Interpretation: Column 2: High fractionalization effect calculated as 0.16 + 0.23 = 0.39. Column 3: Bridge effect at mean road stock (1.64 km) is 0.36 + (-0.06 × 1.64) = 0.26. Column 5: High fractionalization effect is -0.39 + 1.34 = 0.95. Column 6: Bridge effect at mean road stock is -0.49 + (0.74 × 1.64) = 0.72.

potatoes, garlic, cabbage, and silk. These crops differ in their coordination requirements, perishability, and market structure. As a result, they posed distinct logistical and institutional challenges. The results show that villages specialized according to their comparative advantage, which was defined by the intersection of their social structure and the specific economic opportunities the bridge created for each crop.

Table 10 presents the primary findings. Panel A shows the average treatment effect of the bridge, revealing a broad reallocation of resources away from subsistence potatoes (-1.97 tons/hh) and toward market-oriented rice (+0.04 tons/hh) and cabbage (+0.25 tons/hh). Panel B decomposes these averages and reveals the central role of social structure. High fractionalization villages drove the expansion in cabbage and silk production, with the triple-interaction coefficients (+0.17 and +1.19, respectively) indicating significantly larger effects relative to cohesive villages.

The case of cabbage is particularly illustrative. As a highly perishable crop, its cultivation was previously constrained by the risk of local market saturation. The bridge solved this bottleneck by enabling bulk sales to mainland wholesalers. Fractionalized villages, seeking alternatives to rice, disproportionately seized this new opportunity. The net effect for this group was a 0.38 ton increase per household, a 264% rise from the pre-period mean. In contrast, the universal abandonment of potato cultivation (Column 2) shows that when the opportunity cost of subsistence farming rose for everyone, both village types exited in equal measure.[22]

The pattern for silk production highlights a different mechanism: state intervention. As a government-purchased commodity, silk offered stable returns that bypassed local market risks. This relatively safe bet was primarily taken up by fractionalized villages, for whom the net effect was a significant increase in production (+0.52 on the log scale). This sug-

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[22]The estimated increase of 0.38 tons of cabbage per agricultural household in high-fractionalization villages translates to approximately 127 additional napa cabbages per household, assuming an average head weight of 3 kg. At historical yield levels of 30–40 tons per hectare (i.e., 3–4 kg/m^2), this additional output would require only 110–130 square meters of land (roughly 0.011–0.013 hectares), suggesting that modest land reallocations, rather than major structural changes. Cabbage was a perishable but high-return crop, especially valuable during the fall harvest when demand surged for kimchi-making. Wholesale prices in 1973 averaged 30 KRW per kilogram, implying that the additional 380 kg generated roughly 11,400 KRW in extra income per household. To put this in perspective, rural daily wages in 1973 were approximately 200–300 KRW, making the cabbage gains equivalent to 38–57 days of labor income, around 1.5 to 2 months' worth of earnings from one crop season.

gests that for these villages, diversification was a portfolio strategy, combining market-based opportunities like cabbage with state-supported niches like silk.[23]

Appendix Table A.34 examines the mechanisms underpinning this specialization by examining how the bridge's impact was moderated by different types of infrastructure. Panel A tests the "input/bulk" channel, proxied by stock of newly built feeder roads. Road construction had a large and significant effect on the abandonment of bulky potatoes (-1.68), but was irrelevant for other crops. Panel B tests the "output/transaction" channel using distance to township markets. This channel was the primary driver of the cabbage boom. The coefficient of +0.04 implies that a one-standard-deviation (4.82 km) increase in distance from a market was associated with a 0.19 ton larger increase in cabbage output per household. This confirms that the bridge's main benefit was solving the perishability trap for previously isolated producers by connecting them to new bulk merchants. A similar, though smaller, effect is found for rice (+0.06). As hypothesized, this channel was irrelevant for the state-procured silk and the non-marketed subsistence potato crop. This criss-cross pattern of results provides evidence that the definition of "effective infrastructure" is endogenous to the economic strategy pursued. The physical capital that mattered most was the one that solved the specific logistical bottleneck of the crop that a village's social structure led it to adopt.

Overall, these crop-specific patterns demonstrate that agricultural diversification in fractionalized villages was strategic specialization. These communities systematically identified and exploited opportunities where market access could substitute for collective coordination. The portfolio of cabbage (market-integrated), silk (state-supported), and other special-use crops created multiple income streams while avoiding the coordination requirements of modernized rice cultivation. This adaptation—enabled by infrastructure but shaped by social constraints—challenges simple narratives about development requiring either pure markets or strong collective institutions.

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[23]Small-scale silk production became largely obsolete by 1980 due to the widespread availability of synthetic fabrics like nylon. The negative coefficient (–0.67) suggests that cohesive villages were the first to abandon silk production, while more fractionalized villages were slower to transition.

Table 10: Strategic Crop Specialization Following Bridge Construction

	Output per Agricultural Household (tons)				$log(Output + 1)$
	(1) Rice	(2) Potatoes	(3) Garlic	(4) Cabbage	(5) Silk
Panel A: Average Treatment Effect (DiD)					
$I_i^{Bridge} \times Post_t$	0.04	-1.97***	-0.00	0.25***	-0.07
	(0.09)	(0.18)	(0.01)	(0.04)	(0.30)
Panel B: Heterogeneity by Social Fractionalization (DDD)					
$I_i^{Bridge} \times Post_t$ *(Low-Frac. effect)*	0.19**	-1.97***	-0.00	0.20***	-0.67**
	(0.09)	(0.20)	(0.01)	(0.04)	(0.29)
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$	-0.30**	-0.03	0.00	0.17**	1.19**
	(0.13)	(0.28)	(0.02)	(0.08)	(0.49)
Interpretation:					
Net effect for high-frac. villages	-0.10	-2.00***	-0.00	0.38***	0.52
Crop Characteristics:					
Coordination Requirements	High	Low	Low	Low	Medium
Perishability	Medium	Low	Low	High	Medium
Market Orientation	Local/State	Subsistence	Urban	Urban	State
Demographic Controls	✓	✓	✓	✓	✓
Village and Year FEs	✓	✓	✓	✓	✓
Log(Farmland$_{i,1972}$) × Year FE	✓	✓	✓	✓	✓
Mean of Y (Pre-1973)	0.89	1.35	0.06	0.14	115.9 kg
Observations	1,358	1,135	924	924	982

Notes: This table reports the effect of bridge access on output per agricultural household across different crops. The dependent variable is output per agricultural household for all crops except silk, which could be produced by both agricultural and non-agricultural households. For silk, the outcome is the log of the total village output. The number of observations varies across columns due to missing crop data in certain years; missing values are not assumed to be zero. All specifications include village and year fixed effects, interactions between year fixed effects and log(1972 farmland area), and demographic controls (log population, household size, and the share of female residents). Panel A shows the average treatment effect using a difference-in-differences (DiD). Panel B reports heterogeneous effects from a triple-difference (DDD) model, separating the effect for low-fractionalization villages (the baseline DiD term) from the additional effect in high-fractionalization villages (the triple-interaction term). Standard errors, clustered at the village level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Aggregate Economic and Demographic Outcomes. The final analysis examines whether the alternative development path chosen by fractionalized villages translated into aggregate economic success. Table 11 presents estimates for village population and household income, revealing that diversification not only retained residents amid nationwide rural exodus but also generated substantial income gains.

Panel A reports triple-difference estimates for village population. The baseline effect for cohesive villages on the connected island is -0.07, indicating population decline relative to the control group. In contrast, the triple-interaction term is +0.10, yielding a net effect of +0.03 for fractionalized villages, a complete reversal of the depopulation trend. This demographic resilience suggests that economic opportunities created through diversification were sufficient to retain households.

Panel B presents household income results. Due to sparse historical records, we estimate a cross-sectional difference-in-differences model for the post-1973 period. The interaction term $(I_i^{Frac} \times I_i^{Bridge})$ is 0.48, indicating that households in fractionalized villages on the connected island had incomes approximately 62% higher than predicted by baseline characteristics and location alone.[24] This implies that fractionalized villages shift from a 35% handicap without bridge access to a 5% net advantage with it, reversing the penalty of fractionalization. While this cross-sectional estimate requires cautious interpretation, its consistency with the population dynamics shows that diversification represented a viable path to prosperity rather than mere subsistence.

These divergent trajectories reflect adaptations to social structure rather than differential endowments. I find no systematic differences in livestock ownership (Appendix Table A.35) or media access (Appendix Table A.36) between village types, suggesting no information or investment gaps drove this divergence. The evidence thus demonstrates how identical infrastructure can generate distinct local equilibria: cohesive villages leveraged collective action for coordination-intensive rice cultivation, while fractionalized villages exploited individual autonomy to develop diversified market enterprises. Both strategies delivered economic gains, underscoring how physical capital's impact depends fundamentally on its interaction with local social capital.

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[24]$e^{0.48} - 1 = 62$

Table 11: Aggregate Economic and Demographic Outcomes

	(1) Log(Village Population)	(2) Log(Household Income)
Panel A: Village Population (Full DDD)		
$I_i^{Bridge} \times Post_t$ *(Low-Frac. Effect)*	-0.07** (0.03)	
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$	0.10*** (0.04)	
Panel B: Household Income (avg. 1975-79)		
I_i^{Frac}		-0.43** (0.18)
$I_i^{Frac} \times I_i^{Bridge}$		0.48** (0.19)
Demographic Controls	✓	✓
Fixed Effects	Village, Year	Township
Observations	1,310	96
Number of Villages	196	96
R-squared	0.97	0.33

Notes: This table presents the effect of bridge access on aggregate outcomes. Panel A estimates a triple-difference (DDD) model for village population. Panel B estimates a cross-sectional difference-in-differences (DiD) model for household income, restricted to the post-1973 period due to data limitations. All specifications control for the log of total village farmland, average household size, and share of women. The income regression additionally controls for the log of population. Population data (Column 1) are from the *Statistical Yearbooks of Namhae County* covering all 196 villages. Income data (Columns 2) are from *History of Our Village*, covering 97 villages with available income records. The income regression includes township fixed effects. Standard errors, clustered at the village level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

7 Conclusion

This paper demonstrates that infrastructure returns are not fixed technological parameters but emerge from the interaction between physical capital and local social institutions. Using the 1973 Namhae Bridge construction as a natural experiment, I find that villages with different clan-based social structures pursued divergent but equally successful development strategies. Cohesive villages leveraged collective action to modernize rice production, achieving 31% productivity gains through coordinated investments in feeder roads and mechanization. Fractionalized villages, unable to overcome coordination barriers, pivoted to individualistic strategies—expanding cabbage production by 271% where the bridge solved perishability constraints and shifting to state-procured silk where stable prices required no collective marketing.

These findings advance three literatures. First, they explain heterogeneous infrastructure returns by showing that effectiveness depends on alignment with local organizational capacity. Second, they challenge the view that fractionalization uniformly impedes development, revealing that diverse communities can thrive through market-oriented adaptation when infrastructure enables individual initiative. Third, the findings challenge linear narratives of development by showing that multiple equilibria can be equally efficient, determined by the fit between economic opportunities and social structures.

These findings carry important policy implications. Standard cost-benefit analyses assuming homogeneous treatment effects will systematically misallocate resources. In my setting, a naive calculation would have predicted minimal returns in fractionalized villages, yet these communities generated substantial gains through alternative channels. This suggests that optimal infrastructure design requires understanding not just average returns but the distribution of organizational capacities and how different communities might adapt. This tailored approach could enhance both efficiency and equity.

Several limitations warrant attention. While clan structure provides variation in social cohesion, I cannot rule out all confounders correlated with historical settlement patterns. The income results, based on a subset of villages with surviving records, require cautious interpretation. Most importantly, although both development paths generated similar household

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income, I cannot assess their relative welfare implications—the psychic costs of abandoning traditional farming or the externalities from different land use patterns remain unmeasured. Future research should examine the persistence of these divergent paths and their intergenerational consequences.

Finally, the Korean context offers broader lessons for development policy. The deep, kinship-based social divisions that drove these divergent paths were invisible to standard measures of fractionalization, yet they powerfully shaped economic behavior. This highlights that even in apparently uniform societies, informal institutions and long-standing social norms can be first-order determinants of development outcomes. Understanding how infrastructure interacts with these deep social foundations—whether in rural Africa's ethnic divisions or India's caste structures—remains crucial for designing effective place-based policies. As developing countries scale up infrastructure investment, understanding how returns depend on local social structures will prove crucial for both efficiency and equity.

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A Online Appendix

Contents

A.1 Background

A.1.1 The Development of Localized Lineage Organizations

Definition of Kinship. "The indigenous kinship ideology, with its celebration of status hierarchy and status exclusivity, ran like a red thread through Korea's history from early Silla to the late nineteenth century," claimed Martina Deuchler, a renowned historian on Korean history (Deuchler 2015). Kinships had been the defining social characteristic of Korean communities for centuries and shaped the way these communities organized themselves.

A kinship group in Korea is identified by a combination of a family name and specific regional origins. For instance, the Parks from *Miryang* city and the Parks from *Bannam* county are considered distinct kinship groups, despite sharing the same surname. These groups are often referred to as *bon-gwan*. Each *bon-gwan* has its own genealogical records (known as *jokbo*) documenting the family history and lineage. An example of the genealogical records from the Seol family from *Gyeongju* city is shown in Figure A.1.

The concept of *Bon-gwan* provides a strong sense of identity and establishes a structured hierarchy within villages. Dominant local elite groups not only influence local political dynamics and governance, but also shape social interactions, orchestrating marriage arrangements to maintain or enhance their social status, hosting and sponsoring communal festivals and rituals to reinforce their leadership, and spearheading local business ventures (Brandt 1971, Wade 1982).

Persistence and Significance of Clan Villages. A unique characteristic of Korean kinship groups is their tendency to cluster geographically, forming clan villages where a single clan comprises the majority of the village population. This distinctive social organization was noted by Japanese colonial authorities during their occupation, and they included a survey on family clans and their geographic distributions as an appendix to Korea's first modern census in 1930.

According to the 1930 census, there were approximately 15,000 clan villages nationwide at the time, accounting for about one-third of all villages. Among the 1,685 notable clan villages for which their period of formation could be traced, 207 had existed for over 500

years, 646 for 300-500 years, 351 for 100-300 years, 23 for less than 100 years, and 458 were of unknown origin. This data suggests that clan villages were predominantly formed around 300-500 years ago, between the 15th and 17th centuries (National Institute of Korean History 2023).

This predominance of specific clans in villages continued well into the 20th century. Although the next survey on family clans was not conducted until 1985, three pieces of evidence demonstrate continuing trend, especially in rural areas where rapid industrialization had not yet occurred.

First, a village leader of *Pungdeok* village in *Gyeonggi* province, Sae-Young Lee, documented the changes in clan composition of the village from 1945 to 2000 in his book *The Village History of Pungdeok Village* (Lee n.d.). Throughout this period, the Lees from *Jeonju* city made up the majority of households, ranging from 70 to 90 percent. While the total number of households in the village started to decline in the 1980s, the share of Lee families remained consistently above 80 percent, demonstrating the resilience of the kinship-based social structure despite demographic changes.

Second, a similar pattern was observed in *Eonyang* province, now part of *Ulsan* city. Based on social security data, Park (2013) and Park (2018) find that the share of the population belonging to kinship groups grew consistently from 1910 to the late 1960s in 14 villages where this research was conducted. For instance, the number of kinship groups with at least 15 households of the same surname increased from 17 in 1912 to 45 in 1962. Additionally, their share of the total households rose from 20.9% in 1912 to 44.5% in 1962 (Rhee 2015).

The significance of clan compositions in 20th-century Korea is also well documented in *Glorious Footsteps*, an annual publication issued by the Ministry of Internal Affairs from 1978 to 1985 (The Ministry of Home Affairs 1978). This series featured case studies of approximately 50 successful villages each year, providing detailed accounts of each community's development history. These publications frequently highlighted clan composition as a defining characteristic that influenced how villages overcame development challenges, underscoring its importance in local governance and decision-making. In subsection A.1.3, I illustrate this concept in greater detail by comparing case studies of two villages with varying clan compositions.

Together, these examples illustrate that villages' clan compositions were not only a historical phenomenon but continued to play a vital role in rural Korean communities throughout the 20th century.

Origins of Clan Villages.   The origins of clan villages in Korea are multifaceted, involving a combination of religious beliefs, cultural practices, and economic strategies.

Clan villages emerged from the widespread adoption of Confucian beliefs during the 14th to the 18th century, a period known as the "Confucian transformation" (Deuchler 1992). With the establishment of the *Joseon* dynasty in 1392, Confucian principles became national doctrines. Korean Confucianism particularly emphasized the patrilineal family order, as codified in the clan law, known as *jong-bup*. However, the permeation of these doctrines into rural societies was a gradual process that unfolded over centuries.

The key element of the clan law was its alignment of ancestral rites with patrilineal succession, a practice that excluded daughters from the line of succession. Ancestral rites are central to Confucian values, emphasizing honoring one's ancestors through rituals performed by descendants. The exclusion of daughters ensured that the responsibility for these rites remained within the male lineage, reinforcing the patriarchal structure of the society.[25]

Consequently, property and family leadership were passed down exclusively through male descendants, and daughters gradually lost their inheritance rights. Before the implementation of the clan law, daughters were equally likely to remain in the same village after marriage. This would contribute to clan heterogeneity of villages, since they would then belong to their husband's family name. However, with the wider adoption of the clan law, it became customary for daughters to leave their natal villages upon marriage, because immovable assets, such as houses, could only be inherited through the male line. As patrilinear succession became entrenched, villages began to form around dominant patrilinear kinship groups. In short, the increasing alignment of genealogical practices with patrilineal principles drove the formation of clan-based villages.

Along with the religious changes, agrarian practices around rice farming likely accelerated

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[25]This cultural shift is evident in the changes in recording of genealogies. In the 14th century, genealogies were composite, including both paternal and maternal lines. However, by the 17th century, as the belief that ancestral rites should be performed by the eldest son became more predominant, genealogies evolved to focus solely on patrilinear descendants (National Institute of Korean History 2023).

the adoption of the patrilineal family order and made the formation of clan-based villages sensible (Lee 1993). Rice farming is labor-intensive, requiring collective coordination and cooperation among villagers. Examples include community-managed irrigation systems, and synchronizing planting and harvesting schedules. Therefore, rice farming creates incentives for villagers to form strong social ties and mutual obligations based on kinship and clan affiliation. These practices became ingrained in the culture and remain in the forms of informal institutions, such as *doore* (village councils), *gye* (village cooperation associations), and *poomasi* (labor-sharing arrangements). This clan-based culture, rooted in agrarian practices and the Asian-specific economic and religious context, endured over time, even after modernization efforts in the 20th century.

A.1.2 The *New Village Movement*: Decentralization of Public Goods Provision

A lesser-known aspect of Korea's economic development is that it was accompanied by a 60% growth in agricultural productivity. Figure **??** plots rice output per agricultural household and rice yield between 1965 and 1979, with values from 1970 normalized to 100. In less than a decade, both measures of agricultural productivity increased by 40% to 60%. This productivity growth resulted in a subsequent rise in rural income. Between 1974 and 1978, the average income of agricultural households exceeded that of urban households and continued to grow at a similar rate to urban income until 1984.

The rapid agricultural productivity growth and income during the 1970s were driven by two concurrent economic policies: the expansion of transport infrastructure networks and the decentralization of public goods provision, known as the *New Village Movement*.

Expansion of Transport Infrastructure. The Korean government pursued ambitious national transport infrastructure projects during this period. For instance, the first large-scale highway, the Gyeongbu Expressway, spanning 428 km between Seoul and Busan, was completed in 1970. By the end of 1973, two additional major highway networks were added: the Honam Expressway (260.7 km) and the Namhae Expressway (273.17 km), totaling 533 km. The Namhae bridge, connecting Namhae island (the fourth largest island in Korea) to the Namhae Expressway, was also completed in 1973.

This paper focuses on the construction of this new bridge, which marked a pivotal moment in the region's development. One of the most immediate and tangible impacts was the expansion of bus services. Bus availability on the island grew relatively slowly prior to the bridge's completion, increasing from 12 to 34 buses over a decade (1963-1973). However, in just five years following the bridge's opening (1973-1977), the number of buses more than doubled to 76. This indicates a fast expansion of public transportation network and increased mobility for the residents (Namhae County Office 1980).

The bridge's construction, coupled with the expansion of bus services, created a growing demand for improved connectivity *within* the island. This presented both opportunities and challenges for individual villages. On the one hand, the bridge and bus services increased the potential for villages to connect with the larger transportation network, incentivizing villagers to engage in public goods provision, particularly road construction projects. On the other hand, not all villages were equally positioned to capitalize on these new opportunities. The ability to construct connecting village roads often required significant coordination within villages, including potentially relocating houses and resolving differences of opinions among residents. These contrasting effects underscore the potential for heterogeneous responses based on villages' internal characteristics.

The *New Village Movement*.   The expansion of transport infrastructure coincided with the launch of a rural development campaign known as the *New Village Movement*. This nationwide, community-driven program provided government transfers to local communities conditional on their use for investments in public goods. A key element of this initiative was the decentralization of public goods provision, which delegated authority for fund allocation to village leaders. Villagers were responsible for all phases of the projects, from planning and implementation to monitoring. Often, they matched government transfers with voluntary labor and material contributions.

In 1970, the *New Village Movement* began by distributing the same amount of cement to all villages for small-scale infrastructure projects. By the end of the decade, nearly all of the 36,000 villages in Korea had participated, and public interest and support for the movement were often described as "spreading like wildfire" (The Ministry of Home Affairs

1978). Between 1970 and 1979, 43,506 km of new village rural roads were constructed and paved, and virtually all villages rebuilt their community centers (The Ministry of Home Affairs 1980). Traditional thatched roofs were replaced with modern metal roofs throughout the countryside. To this day, the success of the *New Village Movement* is celebrated across the country. Flags symbolizing the movement are commonly seen, especially in rural areas. The President of South Korea appoints the president of the *New Village Movement* organization, and an annual convention is held, consistently attended by the President of South Korea.

The *New Village Movement*'s emphasis on decentralization highlighted the importance of local informal governance and provided villagers with the flexibility to choose their own priorities. Despite ongoing controversies over the extent of discretion villages actually had, the *New Village Movement* was fundamentally a grassroots initiative. Village leaders were responsible for reaching a consensus on project priorities, encouraging participation, and budgeting. It was not uncommon for their suggestions to be rejected by villagers (Han 2010). Figure ?? shows the evolution of project budgets in *Namhae* county during the 1970s. Villagers' contributions comprised most of the budget, a feat that would have been difficult to achieve without their significant influence over project choices. The *New Village Movement* allowed local communities to actively shape their development, fostering a sense of ownership and civic engagement. The *New Village Movement* bears a strong resemblance to contemporary community-driven development projects, but it was much larger in scope and had a strong top-down commitment to achieving its objectives.

A.1.3   A Case Study of Two Villages with Different Clan Compositions

In this subsection, I contextualize how village clan composition shaped approaches to rural development in 1970s Korea, with a focus on road construction projects. Through a comparative study of two villages, I argue that both the kinship-based social structures and economic incentives played crucial roles in overcoming the "tragedy of the anti-commons" problems, where excessive fragmentation of property rights impedes efficient resource use (Heller 1998, Buchanan and Yoon 2000). While clan homogeneity facilitated faster project initiation, I find that the anticipation of increased land values ultimately drove consensus in both homogeneous and heterogeneous villages.

A long-standing aspiration of Korean rural villagers was to gain access to road networks and make villages accessible to buses. However, road infrastructure improvements necessitated significant village-level organization. Villagers had to relocate houses and sell land make way for road construction. In rural Korea, where land ownership was often fragmented, even a small fraction of owners could potentially block the entire development process, making consensus and progress difficult to achieve.

To illustrate these dynamics, I compare two villages, referred to as Village A and Village B,[26] which had different origins and, consequently, distinct clan compositions and economic activities.

Initial Conditions of Two Villages.   Village A was a typical slum settlement, formed by a diverse mix of families that sporadically came together. The residents built earthen houses by arbitrarily clearing mountainsides. The population had grown rapidly from 30 households in 1969 to 189 households in 1978. The majority (88%) of households were non-agricultural. The village was highly fractionalized, with no dominant clans and an average of 7.4 households per family name (The Ministry of Home Affairs 1978).

In contrast, Village B, with its deep historical roots, was traditionally associated with the elite class. Of its 110 households, 89 belonged to the *Euisung* Kim clan, representing a strong clan majority in the village. The village occupied a traditionally ideal geographical setting for settlement, described as "with a mountain at the back and a river in front," which was particularly suitable for rice farming. As a result, 102 of the 110 households were engaged in agriculture.

Despite their different origins, both Village A and Village B faced significant infrastructural challenges. Village A, situated in mountainous terrain, was particularly vulnerable to landslide during rainy season. Village B, located alongside a stream, suffered from annual floods that frequently submerged farmland and houses. Neither village had paved roads,

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[26]The actual names of the villages are *Takbakgol* (Village A) and *Cheonjeonli* (Village B). Both are featured in the 1978 publication of *Glorious Footsteps*, an annual publication by the Ministry of Internal Affairs between 1978 and 1985. This publication provided case studies of selected villages that successfully escaped poverty, presenting around 50 village case studies each year. The typical structure of these case studies includes key village metrics (population, electricity access, geographic conditions, clan composition), descriptions of initial poor conditions, how challenges were overcome through village projects, detailed project information, and meeting logs.

which led to severe mobility issues during the rainy season. Housing infrastructure was equally poor in both villages. Even in Village B, which had historically been associated with the elite class, over 70% of the houses still had thatched roofs, and almost none had fences.

Road Construction Projects. The initiation of road development projects differed significantly between Village A and Village B, primarily due to their distinct clan compositions and consequent abilities to self-organize. These differences highlight how the clan-based social structure of Village B facilitated a more efficient process for initiating the road development project, despite facing similar challenges of fragmented land ownership and initial opposition.

In Village A, the village project of building 2000 meters of additional roads faced considerable initial resistance. Meeting logs reveal widespread skepticism among villagers, with many questioning the project's feasibility. One resident complained: "I can barely take care of my own house, so how can I take care of the village's work?" The project leader, along with a few supportive villagers, had to go door-to-door to explain the benefits and gradually gain consent. Despite these efforts, strong opposition persisted, and a major point of contention was the need to demolish seven buildings on 1,000 square meters of land, belonging to villagers who opposed the project and refused to consent. The village reached a consensus in 1977, seven years into the *New Village Movement*. A breakthrough came when five families donated their land for small compensation, and the project eventually started to gain momentum.

In contrast, Village B's experience, while not entirely smooth, demonstrated a different dynamic. A village project of similar magnitude also received initial backlash, but land donations came earlier and in larger numbers. By 1972, twelve Lee clan members had already contributed their land for the project, and all necessary land donations were completed by 1973. Although land ownership in Village B was also similarly fragmented, it was predominantly owned by the Lees. With senior clan leaders supporting the project, people were more quickly mobilized. Even though each family within the Lee clan was a separate unit requiring individual persuasion, the shared clan identity appeared to facilitate cooperation.

Interestingly, the leaders of both Village A and Village B used a similar argument to persuade opposing residents to contribute their land for road development. In both cases,

potential increase in the value of residents' remaining assets following road construction played a crucial role in motivating residents to participate in the project. While the more homogeneous, clan-based Village B received "compensated land donations" sooner than Village A, the ultimate driver in both cases was economic incentives: the anticipated increase in asset values resulting from improved infrastructure.

These government-conducted case studies should be interpreted with caution, but two clear patterns emerge: 1) the intricate local politics within villages and the significant role of dominant clans in rural development during the 1970s, and 2) the importance of expected returns to better road connectivity. In the rest of the paper, I empirically examine how clan composition and local economic factors mediate the impact of large-scale infrastructure projects, such as bridge construction, on village-level development outcomes. Specifically, I analyze how the benefits of improved market access vary based on a village's clan structure and its proximity to the new infrastructure.

A.2 Further Data Documentation

A.2.1 Data Search and Digitization

This paper focuses on Namhae County, which provides a unique opportunity for data collection due to a set of exceptional circumstances. The groundwork was first laid by local historian Mr. Eui-Yeon Jeong, who dedicated his life to studying Namhae County's history. In particular, between 2016 and 2017, Mr. Jung and his research team visited all 196 village centers in the county, meticulously photographing every old document stored in their archives. Mr. Jung passed away in 2018, and his widow, Ms. Hee-Myung Ahn, who also participated in his research projects, generously shared his entire catalogue with me in 2021. Additionally, Namhae County offered another rare advantage: its county office remained in its original location without major renovations since its establishment, unlike most other counties. This allowed for the preservation of documents predating 1984, when Korea updated its law governing document archiving that prioritized cost-cutting and inadvertently led to the loss of such records elsewhere. However, in Namhae county, these historical documents fortuitously survived, providing an unprecedented wealth of data for this research project.

Data Sources and Digitization Process. I digitized and combined data from two primary sources in Namhae County: village project data from the *History of Our Village* and village-level administrative data from *Township Statistical Yearbook*. To expedite the digitization of 336 volumes (approximately 33,000 pages) of archival documents and to work within financial constraints, I used an off-the-shelf OCR engine to automate the initial stage of the digitization process. An example page of the OCR-processed page is shown in Figure A.2. Recent advances in deep learning have significantly improved the accuracy of automated digitization, and automation has garnered increased attention in social sciences (Shen et al. 2020). The first draft of digitization was then manually reviewed by a data-entry company in India to identify errors. Then, I hired research assistants to further check for errors by comparing the original sub-totals of each column with those from the digitized data.

Overall, the search and digitization efforts resulted in Korea's first village-level panel

data spanning from 1969 to 1984. To my knowledge, this paper is the first to employ such granular data in examining Korea's successful rural development during the 1970s.

A.2.2 Estimating the Distances to the Bridge

This subsection details how distances between villages and the bridge are estimated using distance matrices from the *Statistical Yearbooks of Namhae County.* Figure 7 shows distance matrices for three of the ten local road networks from the 1970 Statistical Yearbook. These matrices provide pairwise distances between destinations along each route. While most stopovers in the matrices represent village centers, some entries indicate regional names for sections where roads pass through unpopulated areas.

Figure 7: Distance Matrices

I calculated the shortest route between each village and the bridge by identifying and comparing all possible travel routes. The calculation process follows two main steps:

(1) For villages with direct road connections to the bridge (requiring no road changes), I use these direct routes as the shortest travel distances. This applies to 18 villages.

(2) For villages requiring multiple roads to reach the bridge, I identify routes that pass through the 18 directly-connected villages mentioned above. The total distance is then calculated by summing two components: the distance from the origin village to

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the directly-connected village, and the distance from that village to the bridge. This method provides distances for 62 additional villages.

This initial process yields accurate distances for 80 villages, representing 47% of the 170 villages in the connected island. For the remaining villages, I employ two additional methods:

First, I use historical "legal" village boundaries to estimate distances for 60 more villages. These boundaries, established during the colonial period and still used in legal documents, were later subdivided into "administrative" villages as populations grew. These administrative divisions follow natural community patterns within legal villages, typically resulting in two or three administrative villages per legal village unit. Since villages within the same legal boundary are usually within 1 kilometer of each other, I assume they share similar routes to the bridge.

Finally, for the remaining 30 villages, I use Google Maps to determine contemporary walking distances to the nearest village with known 1970s bridge distances. For example, if village A's distance is unknown but neighboring village B's 1970s distance is available, I calculate village A's distance by using village B as a reference point and adding the walking distance between them.

A.2.3   Types of Projects Recorded in the *History of Our Village*

The *New Village Movement* framework allowed villages to select projects based on their specific needs. While the government encouraged certain types of projects, the only universal requirement for receiving government support was that projects must create public goods. This section analyzes the distribution of project types and explains the approach used to categorize them.

The *History of Our Village* documents 5,271 village development projects implemented across 120 villages in Namhae county between 1971 and 1982. Given that Namhae county comprised 195 villages in 1971, this historical record covers 62% of all villages. The documented projects encompass 266 unique project types.

Table 12 presents the 15 most common projects, comparing two islands that comprise Namhae county: Namhae island (the larger island connected by the new bridge) and Chang-sun island. These projects align with the major initiatives listed in *The Ten Years of New*

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Table 12: Top 15 Most Common Village Projects

	Total	*Namhae* Island	*Changsun* Island
Total (Entire data set)	5,271	4,420	851
15 Most Frequent Projects			
Housing Improvement (roof amelioration)	322	261	61
Housing Improvement (fence)	308	229	79
Construction of Farm Roads	290	262	28
Expansion of Village Roads	210	164	46
Small Bridges	208	182	26
Modernizing Kitchens	178	138	40
Storage Houses	141	126	15
Installing Water Ways	137	118	19
Small River Arrangements	137	104	33
Public Restrooms	137	96	41
Village Halls	130	121	9
Farm Roads Repairs	126	109	17
Housing Improvement (roof painting)	124	96	28
Sewage Systems	108	102	6
Pavement of Village Roads	88	82	6

Village Movement, published by the Ministry of Home Affairs in 1980 to commemorate the program's achievements. The majority were small-scale infrastructure projects that village residents could implement and manage with local government support.

A.2.4   Categorization of Projects

The 238 unique projects are organized into 15 broad categories, as shown in Table 13. These categories are not mutually exclusive, as some projects serve multiple purposes. For example, *construction of waterways* appears in both *village water management* and *agricultural irrigation* categories, reflecting the overlapping nature of these infrastructure improvements.

Table 13: Categorization of Village Projects

Broad Categories	Detail (*# of the unique projects under each broad category*)
Village Roads	Construction/Expansion/Repair/Pavement/Widening of village/farm/entry/other roads (23)
Village Bridges	Construction/Expansion/Repair of village bridges (3)
Ports	Construction/Expansion/Repair of village ports (3)
Village Water Management	Construction/Expansion/Repair of portable water supply facilities; Construction/Repair of water ways, public wells, and reservoir banks; Establishment/Repair/Covering of sewage system (20)
Village Stream Management	Construction/Repair of breakwaters, weirs (low head dams), reservoir banks, dams; Cleaning/Deepening of river bottom (22)
Roof Improvements	Modernizing/Painting roofs (3)
House Improvements	Renovating houses; Remodeling fences/walls/kitchens (5)
Electricity	Electrification (2)
Miscellaneous Facilities	Public baths, Laundry places, Children's parks, Senior centers, Street lights, Restrooms, Salons, Libraries, etc. (55)
Village Centers	Construction/Expansion/Repair of village centers (3)
Village Warehouse	Construction/Repair of village warehouses or silos (3)
Agriculture	Land reclamation, Vinyl houses, Orchards, Farming machines, Introducing high-yield varieties, Farmland irrigation/arrangement, Construction/Repair of water ways and reservoir banks, Construction/Repair of village warehouses or silos, etc. (57)
Agricultural Irrigation	Irrigation/Arrangement of farmland, Stream channel straightening, Construction/Repair of water ways and reservoir banks, etc. (29)
Foray into New Businesses	Raising diary cattle, Stockbreeding, Oyster farming, Other shellfish farming, Nursery gardens, etc. (31)
All Others	Activities of Women's Association, Training Sessions, Cleaning village roads, Afforestation (32)

A.3 Construction of the Variables

A.3.1 Fractionalization Index Construction.

The 1930 Census recorded family clans that comprised more than 10% of village households (hereafter referred to as *significant clans*). For each village, the census documented the number of households belonging to specific clans, identified by family names and ancestral origins. Within Namhae county, 58 villages contained at least one significant clan, with 27 villages containing multiple such clans.

To calculate clan concentration at the village level, household counts for each village are required. Since the 1930 Census only provides township-level population data, I estimate village-level households by assuming each village's share of township households remained stable between 1930 and 1970. Using village-level population data from the 1972 *New Village Comprehensive Survey*, I apply the 1972 village household shares to the 1930 township household totals.

Population growth in Namhae county led to an increase from 79 villages in 1930 to 196 by 1970. Given the geographical constraints of the two islands comprising Namhae, this growth occurred through village subdivision rather than territorial expansion. New villages typically emerged as subdivisions of existing ones, often retaining the original village name with added numerical suffixes (1, 2, 3, etc.). For these cases, I assume the clan composition of new villages matches their parent villages.

Four clans had households spread across multiple villages. For these cases, I allocate clan households proportionally based on village size. For example, the Park family from Milyang county had 72 households distributed between two adjacent villages: SeokPyung (107 total households) and YangAh (288 total households). I estimate each village's share of the clan's households by multiplying the clan's total households by the village's proportion of combined households. Thus, SeokPyung's estimated Park family households $= 72 \times \frac{107}{107+288} = 19.5$.

For villages with at least one significant clan (clan share $\geq$ 10%), F_i is computed as $F_i = 1 - \sum s_{ic}^2$, where s_{ic} are the shares of significant clans reported in the 1930 census. The remaining share of households $(1 - \sum s_{ic})$ is assumed to be split among many smaller clans (¡10%), each with negligible shares, contributing minimally to $\sum s_{ic}^2$. For villages with

no significant clans, the census provides no clan data, and F_i is assigned a value of 1 to reflect maximal fractionalization, as the absence of a dominant clan suggests many small clans below the 10% threshold. For such villages, $TopShare_i$ and $ClanShare_i$ are imputed as 0, reflecting the lack of reported significant clans.

A.3.2 Converting In-kind Transfers / Contributions to Cash Amounts:

I convert all in-kind transfers and contributions to cash equivalents. This conversion uses market-value data from villages that maintain parallel records of both in-kind transfers and their corresponding monetary valuations.

Figure 8: Conversions of In-kind Transfers to Cash Amounts

(a) A Page with Missing Total in Cash

(b) A Page with the Conversion

Figure 8 presents a section of *History of Our Village* that documents village projects chronologically. The documentation format includes six columns: project type (e.g., road construction, public restroom construction), project specifications (e.g., L=150m, 1 new public restroom), and four budget-related columns detailing the total amount, government support, villager contributions, and external cash donations.

Figure 8a illustrates a 1971 road pavement project extending 150 meters. While the record shows that the government provided 300 bags of cement and villagers contributed 300,000 Korean Won (KRW, approximately $300 USD), the total project cost remains undetermined as the cement contribution lacks monetary conversion. In contrast, Figure 8b demonstrates complete documentation from another village in 1972, where 500 bags of cement provided by the government for constructing six small bridges (total length: 27 meters) were valued

Figure 9: Distributions of the Prices of Cement, Rebar, and Labor
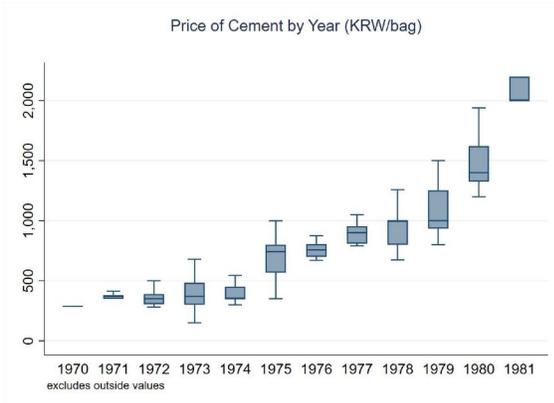
(a) Distribution of Price of Cement
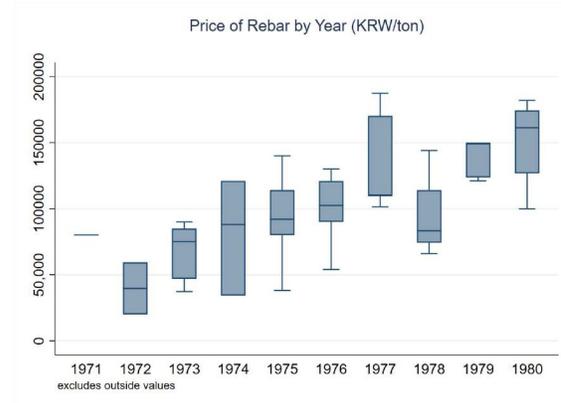
(b) Distribution of Price of Rebar
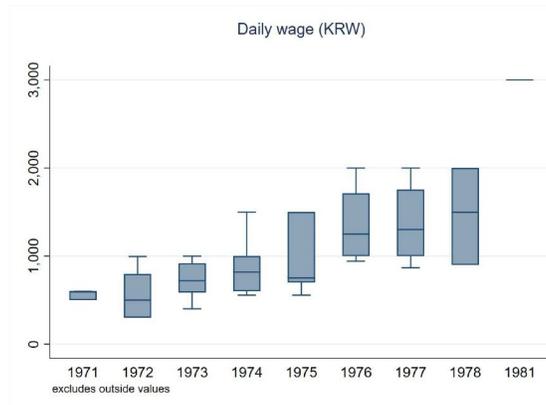
(c) Distribution of Daily Wage

at 160,000 KRW, indicating a market price of 320 KRW per bag.

The dataset contains 481 such price conversions from 120 villages, primarily for cement but also including rebars and daily wages. Figure 9 displays the yearly price distributions for these three inputs. Among the 5,271 projects recorded across 120 villages in Namhae county between 1971 and 1981, I utilized median prices for cement, rebar, and daily wages to monetize 53 in-kind villager contributions and 233 in-kind government support cases. This conversion process expanded the analyzable sample by 244 projects, representing 4.6% of the total project count.

A.4 Additional Figures and Tables

Figure A.1: The Seol clan's *JokBo*, a genealogy book

Figure A.2: An Example Page of OCR Result

Figure A.3: *History of Our Village*
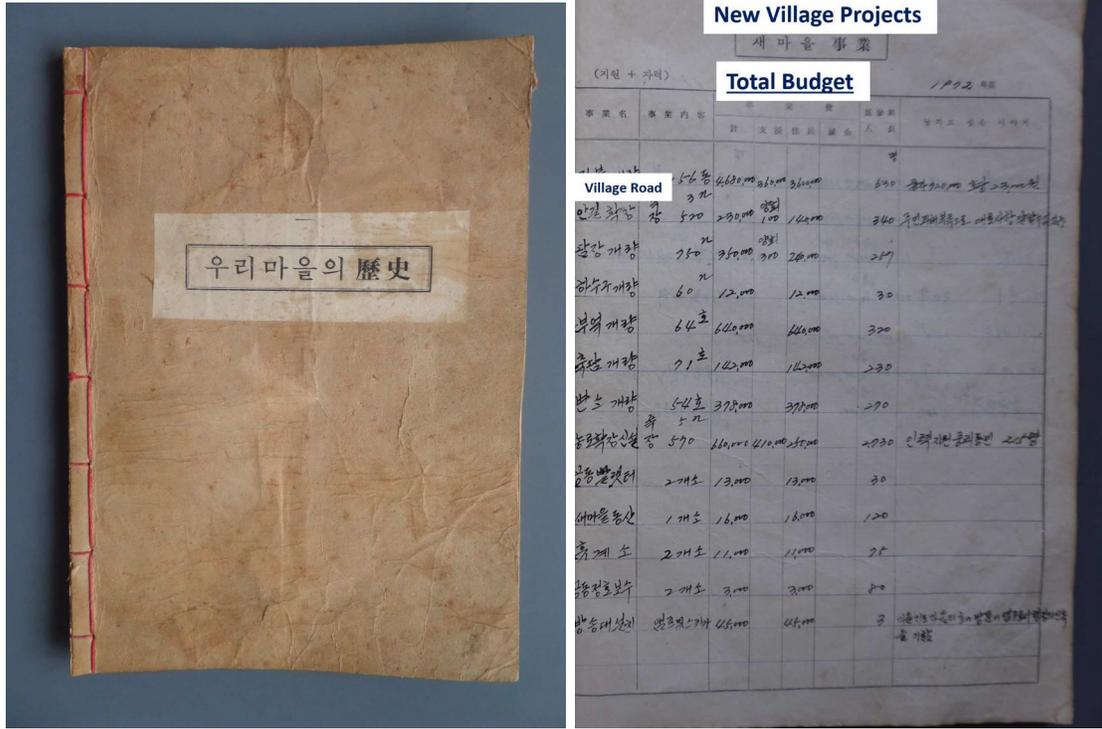
Figure A.4: An Example Page of the *New Village Comprehensive Survey*
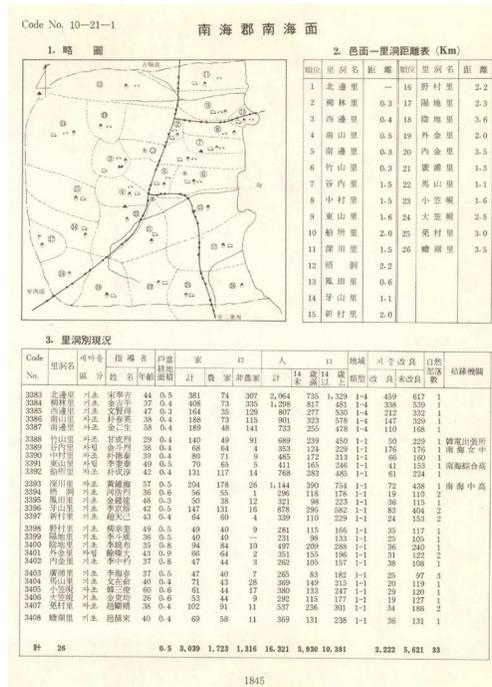
Figure A.5: Evidence of Validity of *History of Our Village*

Figure A.6: Persistence of Clan Fractionalization Across Decades
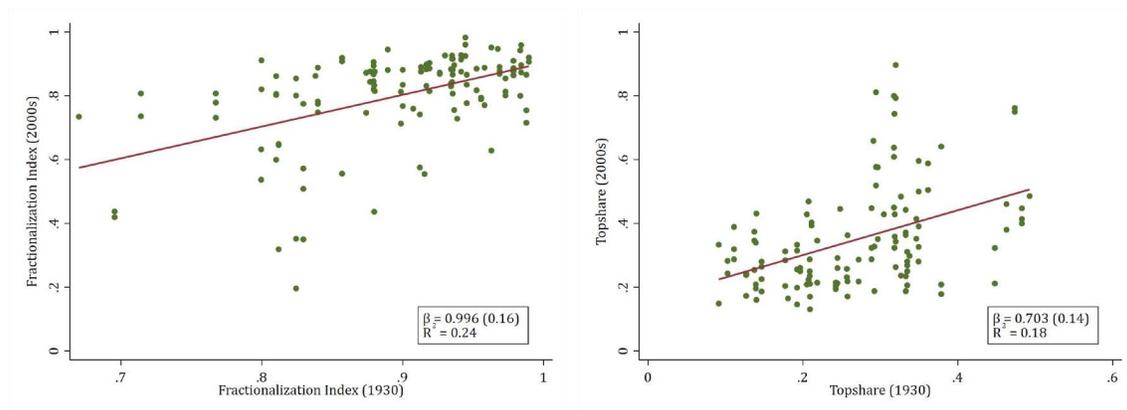
(a) F-index in 1930 vs. F-index in 2000s   (b) TopShares in 1930 vs. TopShares in 2000s

Notes: The left panel shows the correlation between F-index values calculated from 1930 clan composition data and F-index values from 2000s clan distributions. The right panel displays the correlation for TopShare, the share of households belonging to the largest clan. To ensure consistent comparison with 1930 data, the 2000s fractionalization measures include only clans comprising at least 10% of village households. Results remain similar when all clans are included without this threshold. Sample includes all villages for which clan composition data is available in both time periods. $N = 122$ villages.

Figure A.7: Spatial Distribution of the Herfindahl Index in Namhae County
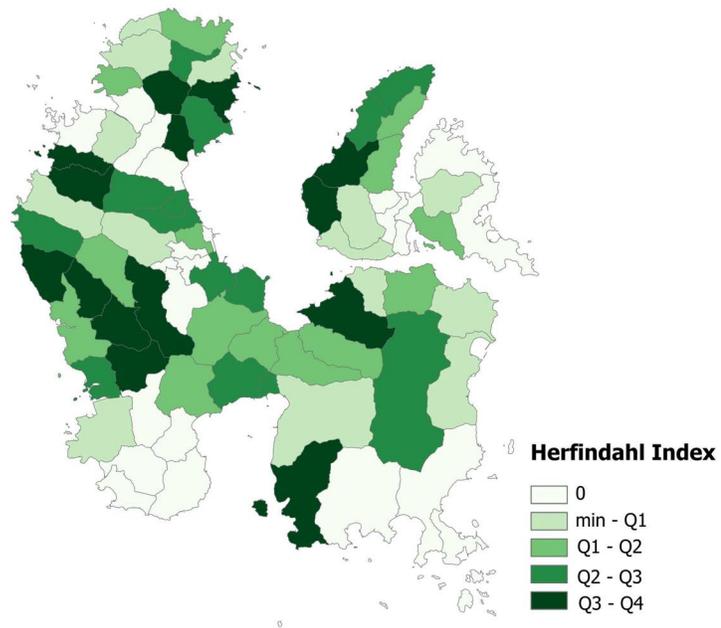
Figure A.8: Event Study of Bridge Impact on Rice Productivity, Long-run
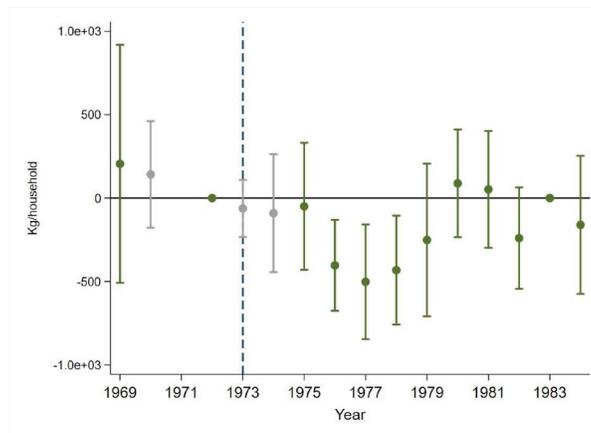
Figure A.9: Event Study of Bridge Impact on Rice Productivity: Robustness Checks 1
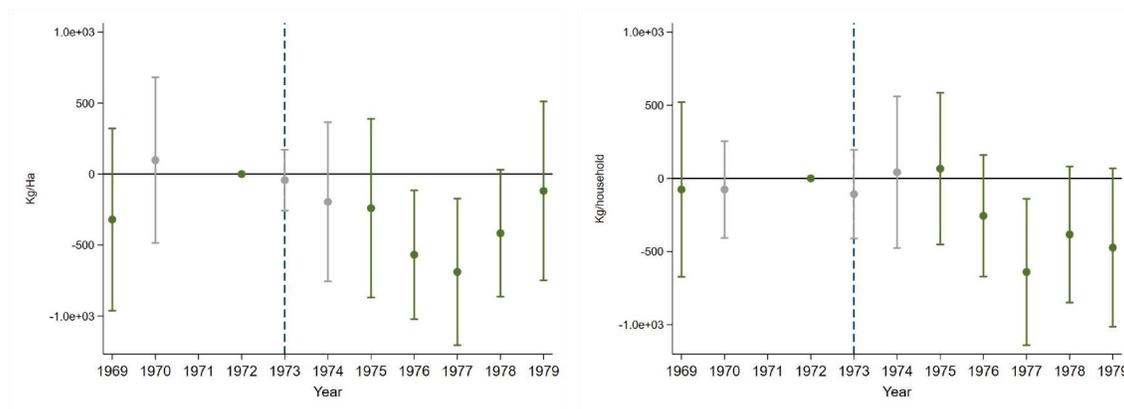
(a) Using Rice Yield

(b) Using $(1 - I_{GradeA})$

Figure A.10: Event Study of Bridge Impact on Rice Productivity: Robustness Checks 2
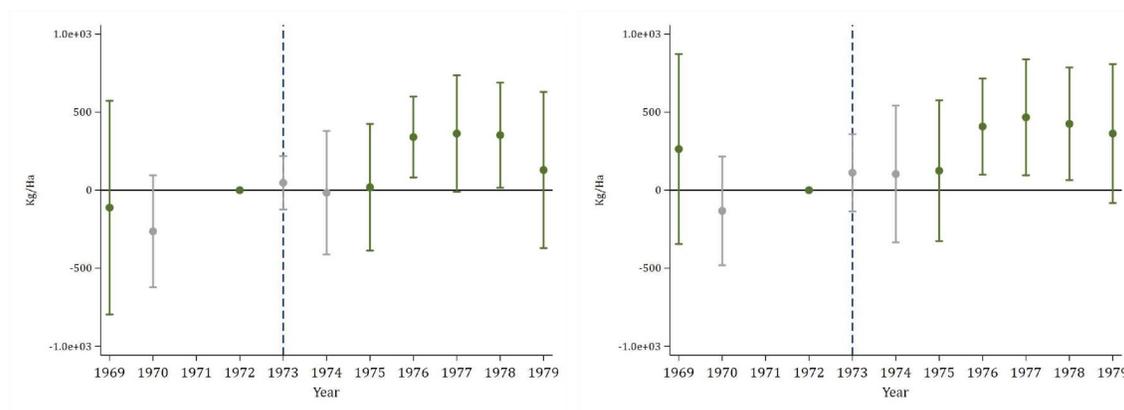
(a) Using $TopShare_i$

(b) Using $ClanShare_i$

Figure A.11: Event Study of Bridge Impact on Road Construction (DiD)

(a) (b)
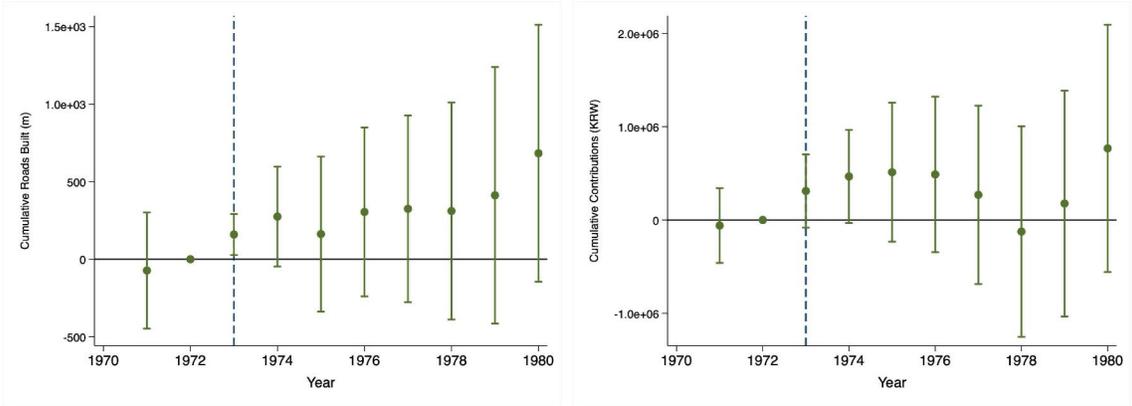
Notes: These figures present event study estimates of the bridge's impact on cumulative roads constructed (meters) and cumulative contribution from villagers. The vertical dashed line marks bridge construction (1973), with 1972 omitted as the baseline year. Both figures show double-difference (DD) estimates comparing connected and unconnected islands. All specifications include village and year fixed effects. Points represent coefficients with 95% confidence intervals based on standard errors clustered at the village level.

Figure A.12: Event Study of Bridge Impact on Road Construction by Social Fractionalization (DDD)

(a) (b)
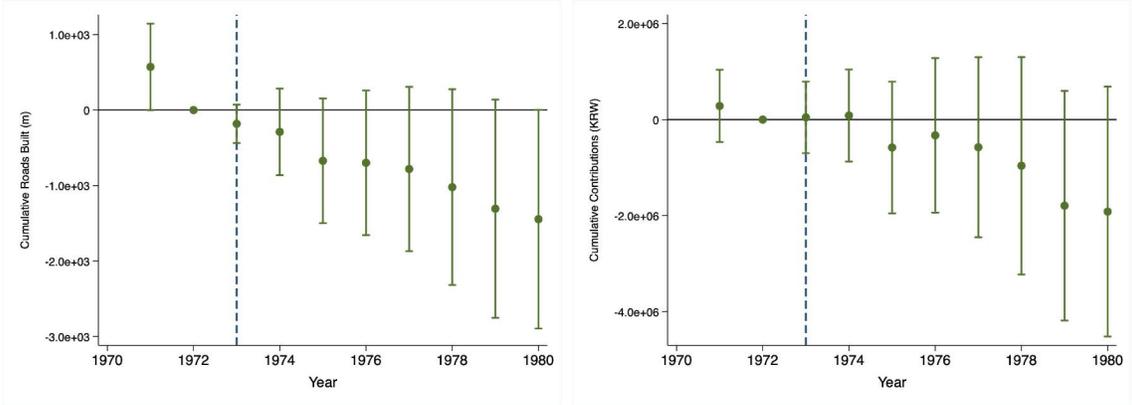
Notes: These figures present event study estimates from a triple-difference model that interacts bridge access with a village being above the median for social fractionalization. The vertical dashed line marks the bridge opening (1973), with 1972 omitted as the baseline year. All specifications include village and year fixed effects. Points represent coefficients with 95% confidence intervals based on standard errors clustered at the village level.

Table A.14: Summary Statistics of the Two Main Data Sources

Panel A: Village Projects	Pooled-Years		By Year		
	Mean (1)	SD (2)	1971 (3)	1975 (4)	1979 (5)
Num. of Projects	36.8	23.4	4.02	4.46	3.42
Avg. Budget per Project	$1,448	$2,146	$546	$1,182	$2,737
Share of Budget on Infrastructure	56%	33%	52%	53%	72%
% of Villages with Grade A			12%	25%	100%
Observations (# *Villages*)	5,278 (120)		528 (112)	528 (112)	429 (102)
Panel B: Village Characteristics	Pooled-Years		By Year		
	Mean (1)	SD (2)	1969 (3)	1975 (4)	1979 (5)
Population	591.6	313.0	689.5	561.2	565.7
Households	111.5	59.5	114.7	113.7	109.1
Agri. Households	92.2	37.6	92.3	94.0	84.1
Cultivated Areas (hectares)	25.6	12.4	25.1	25.3	25.5
Rice Production (tons/village)	99.7	53.5	76.1	89.1	113.9
Power Tillers (units per village)	3.68	3.06	N/A	1.93	5.61
Observations (# *Villages*)	1,370 (196)		(195)	(196)	(196)

Note: This table presents summary statistics from two primary data sources used in this study. Panel A shows village project data from *History of Our Village* records (1970-1979), documenting development activities under the *New Village Movement*. Projects increased in budget size over time, and infrastructure's share of spending grew. The percentage of villages achieving highest performance grade (A) increased from 12% in 1971 to 100% by 1979. Panel B presents village characteristics from *Township Statistical Yearbooks* (1969-1979), showing demographic and agricultural trends. Despite population decline and stable cultivated area, rice production increased by 50% over the period. Technology adoption remained limited, with power tillers (mechanized farming equipment) owned by fewer than 6 households per village by 1979. Sample sizes vary across years and data sources; parentheses indicate the number of villages represented in each column. Korean Won values are converted to USD using an approximate exchange rate of 1,000 Won = 1 USD.

Table A.15: Fractionalization and Geographic & Pre-Bridge Demographic Characteristics

	Fractionalization			
	(1) I_i^{Frac}	(2) I_i^{Frac}	(3) I_i^{Frac}	(4) F_i
Panel A: Geographic Characteristics				
log(land area)	-0.08	-0.13	-0.08	-0.00
	(0.08)	(0.10)	(0.09)	(0.02)
1[stream]	-0.00	0.04	-0.01	0.00
	(0.11)	(0.10)	(0.10)	(0.02)
1[mountains]	-0.01	0.06	0.04	-0.01
	(0.13)	(0.13)	(0.14)	(0.03)
log(farmland per ag. hh.)		0.10	0.08	-0.02
		(0.36)	(0.33)	(0.04)
Cultivated area share of total land		-0.16	-0.09	0.07
		(0.37)	(0.32)	(0.06)
Rice paddy share of cultivated land		-0.70**	-0.62*	-0.07
		(0.34)	(0.37)	(0.06)
Island FEs	✓	✓		
Township FEs			✓	✓
Observations	196	196	196	196
R-squared	0.02	0.06	0.20	0.18
Panel B: Demographic Characteristics				
log(# of households)	-0.01	0.04	-0.01	0.01
	(0.10)	(0.10)	(0.09)	(0.01)
Share of agri. hh.	-0.94***	-0.94***	-0.98***	-0.17***
	(0.23)	(0.23)	(0.26)	(0.04)
Village Type:				
Fishing/Coastal	0.04	0.05	0.13	0.00
(N=16)	(0.17)	(0.17)	(0.13)	(0.02)
Semi-urban	0.11	0.08	0.03	0.01
(N=16)	(0.14)	(0.14)	(0.13)	(0.02)
Island	0.17	0.12	0.28	0.02
(N=29)	(0.22)	(0.24)	(0.21)	(0.03)
Share of pop. <14		1.64***	1.34**	0.12
		(0.57)	(0.54)	(0.09)
Share of women		-1.40*	-0.79	-0.03
		(0.74)	(0.82)	(0.18)
Age of village leader		0.00	0.00	-0.00
		(0.00)	(0.00)	(0.00)
Island FEs	✓	✓		
Township FEs			✓	✓
Observations	196	195	195	195
R-squared	0.14	0.17	0.30	0.28

Notes: This table presents two sets of regressions examining the relationship between measures of social fractionalization and geographic characteristics (Panel A) and demographic characteristics (Panel B). Columns (1)–(3) use I_i^{Frac}, an indicator for villages with above-median levels of social fractionalization, and column (4) uses F_i, a continuous measure. Village type indicators in Panel B are based on the official classification system: General Rural represents standard agricultural villages and serve as the omitted reference category; Semi-Urban represents quasi-urban settlements with populations exceeding 20,000; Mountainous represents villages with over 70% mountainous terrain; Fishing Villages represents communities where over 50% of households engage in fishing; Coastal Villages represents non-fishing coastal villages; Island Areas combines coastal island villages within 2km of shore and inland island villages, and serve as the counterfactual group in the main DDD analysis. Table A.23 reports mean values of key variables across village types for direct comparison of their characteristics.

Table A.16: Fractionalization and Distance Measures

log(Dist. to ...)	Administrative/Economic Centers		Transport Infrastructure	
	Township Office (1)	County Office (2)	Closest Port (3)	Namhae Bridge (4)
I_i^{Frac}	0.08 (0.15)	0.22** (0.10)	-0.33** (0.15)	-0.03 (0.10)
Village Chars. Controls	Yes	Yes	Yes	Yes
Village Type Dummies	Yes	Yes	Yes	Yes
Township FEs	✓	✓	✓	✓
Observations	196	170	196	170
R-squared	0.36	0.78	0.46	0.77

Notes: This table examines the relationship between kinship fractionalization (I_i^{Frac}) and distances to both administrative/economic centers and transport infrastructure (pre-existing ports and the new Namhae Bridge built in 1973). Standard errors are clustered at the legal village level. All models use the logarithm of distance as the dependent variable and include Township fixed effects to control for unobserved time-invariant geographic characteristics. The sample size decreases from 196 to 170 for the County Office (Column 2) and Namhae Bridge (Column 4) regressions because villages located on the smaller, unconnected island lack defined distance data for these destinations. The County Office is located on the larger island and the bridge connects only the larger island to the mainland. Village characteristics controls include log(land area), log(number of households), and the share of agricultural households. Village type dummies include indicators for Fishing/Coastal, Semi-urban, and Island villages, with rural agricultural villages serving as the baseline category. Full regression results with coefficients for all control variables are presented in Table A.25. Similar results hold when using the continuous measure of fractionalization (F_i), as reported in Table A.26.

Table A.17: Fractionalization and Sea Transport

	Has Port (1)	Has Jetty (2)	log(Jetty Length) (3)
I_i^{Frac}	0.21** (0.10)	-0.03 (0.08)	-0.38 (4.84)
Village Chars. Controls	Yes	Yes	Yes
Village Type Dummies	Yes	Yes	Yes
Township FEs	✓	✓	✓
Observations	196	196	70
R-squared	0.38	0.28	0.48

Notes: This table examines the relationship between kinship fractionalization (I_i^{Frac}, a dummy for above-median fractionalization) and sea transport infrastructure in Namhae County. Columns 1 and 2 use binary dependent variables (Has Port, Has Jetty). Column 3 restricts the sample to villages with jetties (70 observations) and uses log(jetty length + 1) as the dependent variable. Standard errors are clustered at the legal village level. All models include township fixed effects to control for unobserved time-invariant geographic characteristics. Village characteristics controls include log(land area), log(number of households), and share of agricultural households. Village type dummies include indicators for fishing/coastal, semi-urban, and island villages, with rural agricultural villages as the baseline. Full regression results with coefficients for all control variables are presented in Table A.27.

Table A.18: Fractionalization and Pre-Bridge Infrastructure Indicators

	Road Network				Public Services		
	Highway (1)	State Rd. (2)	County Rd. (3)	Car Access (4)	log(Schools) (5)	Water (6)	Electricity (7)
I_i^{Frac}	-0.03	-0.04	-0.12*	-0.03	0.03	0.01	0.16*
	(0.07)	(0.07)	(0.07)	(0.08)	(0.04)	(0.04)	(0.09)
Village Chars. Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village Type Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Township FEs	✓	✓	✓	✓	✓	✓	✓
Observations	196	196	196	196	196	196	196
R-squared	0.44	0.37	0.47	0.15	0.18	0.09	0.21

Notes: This table examines the relationship between kinship fractionalization (I_i^{Frac}, a dummy for above-median fractionalization) and pre-bridge infrastructure indicators in Namhae County. Columns 1–4 and 6–7 use binary dependent variables (Highway, State Rd., County Rd., Car Accessibility, Water, Electricity). Column 5 uses log(number of schools+1) as the dependent variable. Standard errors are clustered at the legal village level. All models include township fixed effects to control for unobserved time-invariant geographic characteristics. Village characteristics controls include log(land area), log(number of households), and share of agricultural households. Village type dummies include indicators for fishing/coastal, semi-urban, and island villages, with rural agricultural villages as the baseline. Full regression results with coefficients for all control variables are presented in Table A.28. Similar results hold when using the continuous measure of fractionalization (F_i, Herfindahl index of clan concentration), as reported in Table A.29.

Table A.19: Fractionalization and Economic & Socioeconomic Characteristics

Panel A: Agricultural Production & Structure

	Rice output per hh. (1969) (1)	Barley output per hh. (1969) (2)	log(special-use crop area) (3)	Rice paddies (% of arable) (4)	Share of non-agri. hh. (5)
I_i^{Frac}	-139.87*	-0.12	-0.16***	-0.03	0.08***
	(75.01)	(0.13)	(0.05)	(0.03)	(0.02)
Controls	Yes	Yes	Yes	Yes	Yes
Township FEs	✓	✓	✓	✓	✓
Observations	196	196	196	196	196
R-squared	0.36	0.34	0.55	0.41	0.54

Panel B: Livestock Assets

	log(cows per hh.) (6)	log(pigs per hh.) (7)	log(chickens per hh.) (8)	log(rabbits per hh.) (9)
I_i^{Frac}	-0.05***	0.03*	-0.17	-0.06*
	(0.02)	(0.02)	(0.12)	(0.03)
Controls	Yes	Yes	Yes	Yes
Township FEs	✓	✓	✓	✓
Observations	196	196	196	196
R-squared	0.64	0.31	0.40	0.20

Panel C: Household Amenities & Information Access

	Share of modern roofs (10)	log(TVs per hh.) (11)	log(radios per hh.) (12)	log(newspapers per hh.) (13)	Telephone access (14)
I_i^{Frac}	0.03	-0.01	0.00	-0.00	0.07
	(0.02)	(0.01)	(0.02)	(0.01)	(0.09)
Controls	Yes	Yes	Yes	Yes	Yes
Township FEs	✓	✓	✓	✓	✓
Observations	195	196	196	196	196
R-squared	0.40	0.79	0.65	0.51	0.36

Panel D: Baseline New Village Movement Indicators

	Initial village grade (15)	log(project costs) (16)	log(voluntary contrib.) (17)	log(government support) (18)	log(participants in projects) (19)
I_i^{Frac}	-0.05	0.42	0.31	0.45	-0.04
	(0.06)	(0.48)	(0.56)	(0.80)	(0.13)
Controls	Yes	Yes	Yes	Yes	Yes
Township FEs	✓	✓	✓	✓	✓
Observations	196	120	120	120	120
R-squared	0.05	0.26	0.23	0.19	0.22

Notes: This table examines the relationship between kinship fractionalization (I_i^{Frac}) and pre-bridge economic and socioeconomic characteristics. Binary dependent variables are used in Columns 10, 14, and 15; others use logarithmic measures or shares as indicated. Columns 16–19 restrict the sample to 120 observations due to data availability. Standard errors, in parentheses, are clustered at the legal village level. All models include township fixed effects to control for unobserved time-invariant geographic characteristics. Controls include log(land area), log(number of households), share of agricultural households, and village type dummies (fishing/coastal, semi-urban, island, with rural agricultural as baseline). Full results with all control coefficients for a subset of variables are in Table A.30.

Table A.20: Continuous Measures of Social Fractionalization

	(1) I_i^{Frac}	(2) F_i	(3) $TopShare_i$	(4) $ClanShare_i$
$I_i^{Frac} \times I_i^{Bridge} \times Post_t$	-352.97***	-2,243.68	822.40	651.65
	(127.68)	(1,630.61)	(593.61)	(429.42)
Demographic controls	✓	✓	✓	✓
Village & year FEs	✓	✓	✓	✓
Mean of dep. var.	1,132	1,132	1,132	1,132
Observations	1,364	1,364	1,364	1,364
Number of villages	196	196	196	196
R-squared	0.76	0.76	0.76	0.76

Notes: The dependent variable is rice output per agricultural household measured in kg. Each column presents a triple-difference estimate using different measures of social structure. Column (1) reproduces the baseline specification using a binary indicator for above-median fractionalization. Columns (2)-(4) use continuous measures: Column (2) uses the continuous fractionalization index F_i (ranging from 0 to 1); Column (3) uses the share of the single largest clan in the village (ranging from 0 to 1); Column (4) uses the combined share of all significant clans, defined as those comprising more than 10% of households. Note that columns (3) and (4) measure social homogeneity rather than fractionalization, so positive coefficients would indicate that more homogeneous villages benefit more from infrastructure. All specifications include the full set of double interactions, village and year fixed effects, and demographic controls (log of population, average household size, and share of women in the village population). Standard errors clustered at the village level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.21: Baseline Characteristics by Kinship Fractionalization and Access to the Bridge

	(1)	(2)	(3)	(4)	(5)
Kinship Fractionalization:	$I_i^{Frac}=0$	$I_i^{Frac}=1$	$I_i^{Frac}=0$	$I_i^{Frac}=1$	All Villages
Eventual Access to the Bridge:	$B_i=1$	$B_i=1$	$B_i=0$	$B_i=0$	
Panel A: Demographics & Basic Infra. (1972)					
Num. of villages	90	80	10	16	196
Population	626.9	719.9	818.5	796.1	688.5
Number of Households	105.0	123.2	119.5	127.5	115.0
Share of Non-agricultural HH	0.08	0.21	0.20	0.27	0.15
Avg. Num. of Schools	0.17	0.29	0.20	0.19	0.22
Modern roof share	0.31	0.35	0.31	0.36	0.33
Panel B: Agricultural Prod. & Structure (1969)					
Rice Output per Agri. HH (kg)	932	756	819	917	853
Barley Output per Agri. HH (kg)	1194	1135	1768	1725	1242
Rice Yield (kg/ha)	3227	3140	2726	2786	3130
Cash Crop Area (ha)	3.50	2.67	3.43	3.12	3.12
Number of Cash Crops Grown	4.77	4.34	5.00	4.94	4.62
Share of Arable Land as Rice Paddies	0.65	0.56	0.40	0.54	0.59
Total Cultivated Area (ha)	46.5	41.2	50.1	57.7	45.4
Panel C: Livestock Assets (1972)					
Cows per HH	0.45	0.31	0.51	0.38	0.39
Pigs per HH	0.28	0.30	0.16	0.16	0.27
Chickens per HH	9.45	7.58	5.18	3.84	8.01
Rabbits per HH	0.35	0.25	0.19	0.17	0.28
Panel D: Amenities & Info. Access (1972)					
Radios per HH	0.30	0.28	0.43	0.38	0.31
Newspapers per HH	0.13	0.10	0.05	0.06	0.11
Share of Villages with Telephone Access	0.41	0.61	0.10	0.31	0.47
Panel E: Market Access & Geographic Factors (1972)					
Distance to the Bridge (km)	22.6	25.9	N/A	N/A	24.1
Share of Car Accessible Villages	0.77	0.78	1.00	0.44	0.76
Share of Highway Accessible Villages	0.24	0.23	0.00	0.00	0.20
Share of State Road Accessible Villages	0.14	0.17	0.50	0.38	0.19
Share of County Road Accessible Villages	0.54	0.33	0.60	0.50	0.45
Distance to Closest Admin Office (km)	4.29	6.72	5.84	3.09	5.26
Distance to County Office (km)	9.6	13.9	N/A	N/A	11.6
Panel F: Baseline NVM Indicators (1972)					
Share of Grade A Villages (initial assessment)	0.16	0.10	0.10	0.13	0.13
Initial Project Budget (USD)	1824	2322	753	1645	1953
Initial Voluntary Contributions (% of cost)	0.28	0.19	0.14	0.15	0.24
Initial Project Labor Input (worker-days per capita)	2.54	1.89	1.37	1.86	2.22

Notes: This table presents mean baseline characteristics of villages in Namhae County by kinship fractionalization (I_i^{Frac}) and eventual bridge access (B_i). $I_i^{Frac}=1$ indicates above-median fractionalization (lower clan concentration, based on the Herfindahl index). $B_i=1$ indicates villages on the island connected by the 1973 Namhae Bridge. Columns 1–4 show means for subgroups: homogeneous with bridge access ($I_i^{Frac}=0$, $B_i=1$, 90 villages), fractionalized with bridge access ($I_i^{Frac}=1$, $B_i=1$, 80 villages), homogeneous without bridge access ($I_i^{Frac}=0$, $B_i=0$, 10 villages), and fractionalized without bridge access ($I_i^{Frac}=1$, $B_i=0$, 16 villages). Column 5 shows means for all 196 villages. Panels A, C–F use 1972 data; Panel B uses 1969 data. Panels cover demographics and infrastructure (A), agricultural production (B), livestock assets (C), amenities and information access (D), market access (E), and New Village Movement (NVM) indicators (F). Korean Won values are converted to USD using an approximate exchange rate of 1,000 Won = 1 USD. Distances to the bridge and county office are unavailable for unconnected villages ($B_i=0$). See Table 2 for mean comparisons with p-values.

Table A.22: Balance Test: Villages With & Without Surviving New Village Movement (NVM) Records

	With NVM Records (N = 120)	Without NVM Records (N = 76)	p-value
Panel A: Demographics & Basic Infrastructure (1972)			
Population	709.6	655.0	0.23
Number of Households	122.3	103.6	0.03
Share of Non-Agricultural Households	0.15	0.15	0.88
Avg. Number of Schools	0.23	0.21	0.83
Modern Roof Share	0.33	0.33	0.83
Share of Grade A Villages (initial assessment)	0.14	0.11	0.46
Panel B: Agricultural Production & Structure (1969)			
Rice Output per Agri. HH (kg)	876	816	0.28
Barley Output per Agri. HH (kg)	1250	1230	0.85
Rice Yield (kg/ha)	3084	3200	0.29
Special-use Crop Area (ha)	3.05	3.23	0.49
Number of Special-use Crops Grown	4.58	4.67	0.67
Share of Arable Land as Paddies	0.61	0.56	0.02
Total Cultivated Area (ha)	47.3	42.5	0.09
Panel C: Livestock Assets (1969)			
Cows per HH	0.40	0.38	0.50
Pigs per HH	0.27	0.28	0.72
Chickens per HH	7.67	8.55	0.43
Rabbits per HH	0.28	0.29	0.79
Panel D: Amenities & Information Access (1969)			
Radios per HH	0.29	0.33	0.33
Newspapers per HH	0.11	0.10	0.31
Telephone Access Share	0.49	0.43	0.43
Panel E: Market Access (1972)			
Distance to the Bridge (km)	22.7	26.7	0.03
Share of Car Accessible Villages	0.80	0.68	0.07
Highway Access Share	0.17	0.25	0.21
County Road Access Share	0.48	0.41	0.30
Distance to Admin Office (km)	5.29	5.22	0.94
Distance to County Office (km)	11.2	12.4	0.30
Panel F: Social Structure			
Clan Fractionalization Index (F_i)	0.91	0.94	0.05
Largest clan share ($TopShare_i$)	0.21	0.18	0.14

Notes: This table compares baseline characteristics of villages with (N=120) and without (N=76) surviving New Village Movement (NVM) records. During the 1970s, all villages in Namhae County participated in NVM projects and documented their activities in *History of Our Village* (우리마을의 역사). However, only 120 villages have records that survived and remain accessible today. These surviving records contain the detailed road construction data used in Columns 3 and 6 in Table 9. P-values are from two-sided t-tests of equal means. See Appendix Table A.21 for summary statistics by other village traits.

Table A.23: Village Characteristics by Settlement Type Before Bridge Construction

	General Rural (N=128)	Semi-Urban Villages (N=16)	Mountainous Villages (N=6)	Fishing Villages (N=10)	Coastal Villages (N=6)	Island Areas (N=29)
Panel A: Fractionalization Measures						
I_i^{Frac}	0.42	0.81	0.17	0.80	0.17	0.62
F_i	0.91	0.98	0.83	0.96	0.90	0.95
	(0.09)	(0.04)	(0.11)	(0.07)	(0.04)	(0.05)
$TopShare_i$	0.22	0.06	0.36	0.08	0.29	0.16
	(0.16)	(0.10)	(0.11)	(0.14)	(0.08)	(0.13)
$ClanShare_i$	0.32	0.10	0.51	0.16	0.43	0.20
	(0.24)	(0.17)	(0.20)	(0.30)	(0.17)	(0.20)
Panel B: Geographic Characteristics						
log(land area)	4.94	4.43	5.26	5.47	5.29	5.37
	(0.68)	(0.58)	(0.97)	(0.31)	(0.75)	(0.38)
1[stream]	0.38	0.06	0.83	0.10	0.83	0.10
1[mountains]	0.07	0.06	0.33	0.00	0.17	0.07
log(farmland per ag. hh.)	0.40	0.36	0.52	0.31	0.37	0.48
	(0.07)	(0.15)	(0.17)	(0.04)	(0.03)	(0.23)
Share of cultivated area	0.36	0.43	0.31	0.15	0.21	0.24
	(0.19)	(0.18)	(0.27)	(0.10)	(0.12)	(0.07)
Share rice paddies	0.62	0.62	0.64	0.46	0.61	0.47
	(0.13)	(0.23)	(0.10)	(0.10)	(0.13)	(0.17)
Panel C: Demographic Characteristics						
log(# of households)	4.59	5.02	4.24	4.91	4.51	4.78
	(0.41)	(0.48)	(0.42)	(0.53)	(0.49)	(0.37)
Share of agri. hh.	0.90	0.59	0.97	0.71	0.92	0.76
	(0.11)	(0.26)	(0.04)	(0.24)	(0.13)	(0.17)
Share of pop. <14	0.37	0.37	0.46	0.37	0.36	0.38
	(0.05)	(0.04)	(0.20)	(0.02)	(0.05)	(0.04)
Share of women	0.49	0.50	0.48	0.49	0.48	0.49
	(0.05)	(0.02)	(0.07)	(0.02)	(0.04)	(0.02)
Age of village leader	43.10	47.56	42.83	36.70	36.83	42.28
	(7.99)	(9.52)	(9.52)	(6.13)	(5.38)	(6.52)

Notes: This table presents means and standard deviations (in parentheses) of key village characteristics by settlement type. Village types are based on the official classification system: General Rural represents standard agricultural villages; Semi-Urban represents quasi-urban settlements with populations exceeding 20,000; Mountainous represents villages with over 70% mountainous terrain; Fishing Villages represents communities where over 50% of households engage in fishing; Coastal Villages represents non-fishing coastal villages; Island Areas combines coastal island villages within 2km of shore and inland island villages, and serve as the counterfactual group in the main DDD analysis. Most baseline characteristics differ significantly across settlement types (p<0.01 from F-tests of equality of means across village types, not reported on this table), except for mountainous location and village leader age.

Table A.24: Fractionalization and Geographic & Demographic Characteristics (Homogeneity Measures)

	Homogeneity Measures			
	(1)	(2)	(3)	(4)
	$TopShare_i$	$TopShare_i$	$TopShare_i$	$ClanShare_i$
Panel A: Geographic Characteristics				
log(land area)	0.02	0.03	0.03	0.00
	(0.03)	(0.04)	(0.03)	(0.04)
1[stream]	0.00	-0.01	0.01	0.01
	(0.03)	(0.03)	(0.03)	(0.05)
1[mountains]	0.03	0.01	-0.00	0.02
	(0.04)	(0.04)	(0.04)	(0.07)
log(farmland per ag. hh.)		0.09	0.08	0.08
		(0.11)	(0.11)	(0.13)
Share of cultivated area		0.00	-0.00	-0.05
		(0.13)	(0.11)	(0.15)
Share rice paddies		0.19	0.13	0.21
(% of arable)		(0.12)	(0.11)	(0.19)
Island FEs	✓	✓		
Township FEs			✓	✓
Observations	196	196	196	196
R-squared	0.02	0.06	0.19	0.28
Panel B: Demographic Characteristics				
log(# of households)	-0.03	-0.04	-0.01	0.00
	(0.03)	(0.04)	(0.03)	(0.04)
Share of agri. hh.	0.27***	0.28***	0.35***	0.55***
	(0.07)	(0.07)	(0.08)	(0.11)
Village Type:				
Fishing/Coastal	-0.03	-0.02	-0.03	-0.03
(N=16)	(0.05)	(0.05)	(0.04)	(0.08)
Semi-urban	-0.06	-0.06	-0.05	-0.02
(N=16)	(0.04)	(0.04)	(0.03)	(0.06)
Island	-0.08	-0.08	-0.10*	-0.09
(N=29)	(0.07)	(0.08)	(0.06)	(0.14)
Share of pop. <14		-0.30	-0.18	-0.20
		(0.18)	(0.16)	(0.27)
Share of women		0.17	-0.00	-0.10
		(0.25)	(0.27)	(0.44)
Age of village leader		0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)
Island FEs	✓	✓		
Township FEs			✓	✓
Observations	196	195	195	195
R-squared	0.19	0.20	0.33	0.40

Notes: This table examines the relationship between homogeneity measures and geographic characteristics (Panel A) and demographic characteristics (Panel B). Columns (1)–(3) use $TopShare_i$, defined as the share of households belonging to the largest clan in village i, while column (4) uses $ClanShare_i$, the combined share of households belonging to clans that each account for more than 10% of the village population. Village type indicators in Panel B are based on the official classification system: General Rural represents standard agricultural villages and serve as the omitted reference category: Semi-Urban

Table A.25: Fractionalization and Distance Measures

log(Dist. to ...)	Administrative/Economic Centers		Transport Infrastructure	
	Township Office (1)	County Office (2)	Closest Port (3)	Namhae Bridge (4)
I_i^{Frac}	0.08	0.22**	-0.33**	-0.03
	(0.15)	(0.10)	(0.15)	(0.10)
Controls:				
log(land area)	0.16	-0.03	0.20**	-0.04
	(0.11)	(0.07)	(0.09)	(0.05)
log(# of hh.)	-0.02	0.16*	-0.29**	0.08
	(0.13)	(0.08)	(0.12)	(0.09)
Share of agri. hh.	-0.13	0.20	0.01	-0.17
	(0.37)	(0.26)	(0.34)	(0.22)
Village Type:				
Fishing/Coastal	0.70***	0.39***	-0.68***	0.00
	(0.22)	(0.12)	(0.19)	(0.14)
Semi-urban	-0.46	-0.23	0.22	-0.22
	(0.28)	(0.15)	(0.17)	(0.15)
Island	1.06***		-0.70***	
	(0.24)		(0.25)	
Township FEs	✓	✓	✓	✓
Observations	196	170	196	170
R-squared	0.36	0.78	0.46	0.77

Notes: This table examines the relationship between kinship fractionalization (I_i^{Frac}) and distances to both administrative/economic centers and transport infrastructure (pre-existing ports and the new Namhae Bridge built in 1973). Standard errors are clustered at the legal village level. All models use the logarithm of distance as the dependent variable and include Township fixed effects to control for unobserved time-invariant geographic characteristics. The sample size decreases from 196 to 170 for the County Office (Column 2) and Namhae Bridge (Column 4) regressions because villages located on the smaller, unconnected island lack defined distance data for these destinations. The County Office is located on the larger island and the bridge connects only the larger island to the mainland. Village characteristics controls include log(land area), log(number of households), and the share of agricultural households. Village type dummies include indicators for Fishing/Coastal, Semi-urban, and Island villages, with rural agricultural villages serving as the baseline category.

Table A.26: Continuous Measure of Fractionalization (F) and Distance Measures

log(Dist. to ...)	Administrative/Economic Centers		Transport Infrastructure	
	Township Office (1)	County Office (2)	Closest Port (3)	Namhae Bridge (4)
F_i	-0.49	0.26	-1.37**	-0.52
	(0.74)	(0.77)	(0.62)	(0.46)
Controls:				
log(land area)	0.15	-0.03	0.19*	-0.04
	(0.11)	(0.07)	(0.10)	(0.05)
log(# of hh.)	-0.02	0.13	-0.25**	0.08
	(0.13)	(0.09)	(0.12)	(0.09)
Share of agri. hh.	-0.28	-0.03	0.11	-0.23
	(0.37)	(0.29)	(0.36)	(0.21)
Village Type:				
Fishing/Coastal	0.71***	0.41***	-0.70***	0.00
	(0.22)	(0.12)	(0.19)	(0.14)
Semi-urban	-0.45	-0.23	0.22	-0.22
	(0.28)	(0.15)	(0.17)	(0.15)
Island	1.09***		-0.78***	
	(0.25)		(0.23)	
Township FEs	✓	✓	✓	✓
Observations	196	170	196	170
R-squared	0.36	0.76	0.44	0.77

Notes: This table examines the relationship between kinship fractionalization (F_i) and distances to both administrative/economic centers and transport infrastructure (pre-existing ports and the new Namhae Bridge built in 1973). Standard errors are clustered at the legal village level. All models use the logarithm of distance as the dependent variable and include Township fixed effects to control for unobserved time-invariant geographic characteristics. The sample size decreases from 196 to 170 for the County Office (Column 2) and Namhae Bridge (Column 4) regressions because villages located on the smaller, unconnected island lack defined distance data for these destinations. The County Office is located on the larger island and the bridge connects only the larger island to the mainland. Village characteristics controls include log(land area), log(number of households), and the share of agricultural households. Village type dummies include indicators for Fishing/Coastal, Semi-urban, and Island villages, with rural agricultural villages serving as the baseline category.

Table A.27: Fractionalization and Sea Transport

	Has Port	Has Jetty	log(Jetty Length)
	(1)	(2)	(3)
I_i^{Frac}	0.21**	-0.03	-0.38
	(0.10)	(0.08)	(4.84)
Controls:			
log(land area)	-0.10	-0.04	-0.29
	(0.06)	(0.08)	(3.57)
log(# of hh.)	0.15*	0.23**	12.93*
	(0.08)	(0.09)	(7.13)
Share of agri. hh.	-0.06	-0.31	-10.31
	(0.22)	(0.32)	(22.28)
Village Type:			
Fishing/Coastal	0.44***	0.34*	1.09
	(0.14)	(0.18)	(3.50)
Semi-urban	-0.13	-0.27**	-7.81
	(0.12)	(0.13)	(6.41)
Island	0.50***	0.32	-2.63
	(0.16)	(0.25)	(5.49)
Township FEs	✓	✓	✓
Observations	196	196	70
R-squared	0.38	0.28	0.48

Notes: This table examines the relationship between kinship fractionalization (I_i^{Frac}, a dummy for above-median fractionalization) and sea transport infrastructure in Namhae County. Columns 1 and 2 use binary dependent variables (Has Port, Has Jetty). Column 3 restricts the sample to villages with jetties (70 observations) and uses log(jetty length + 1) as the dependent variable. Standard errors are clustered at the legal village level. All models include Township fixed effects to control for unobserved time-invariant geographic characteristics. Village characteristics controls include log(land area), log(number of households), and the share of agricultural households. Village type dummies include indicators for Fishing/Coastal, Semi-urban, and Island villages, with rural agricultural villages as the baseline category.

Table A.28: Fractionalization and Pre-Bridge Infrastructure Indicators

	Road Network				Public Services		
	Highway (1)	State Rd. (2)	County Rd. (3)	Car Access (4)	log(Schools) (5)	Water (6)	Electricity (7)
I_i^{Frac}	-0.03	-0.04	-0.12*	-0.03	0.03	0.01	0.16*
	(0.07)	(0.07)	(0.07)	(0.08)	(0.04)	(0.04)	(0.09)
Controls:							
log(land area)	-0.08	-0.16***	0.08*	0.03	0.01	-0.05	-0.00
	(0.06)	(0.06)	(0.04)	(0.05)	(0.03)	(0.05)	(0.06)
log(# of hh.)	0.18***	0.12	0.08	0.14	0.18***	0.05	0.13
	(0.06)	(0.08)	(0.07)	(0.09)	(0.05)	(0.05)	(0.09)
Share of agri. hh.	0.11	0.07	0.20	0.20	0.03	0.19	0.65***
	(0.16)	(0.27)	(0.21)	(0.27)	(0.12)	(0.13)	(0.21)
Village Type:							
Fishing/Coastal	-0.26***	-0.14*	0.11	-0.35***	0.11	0.03	-0.27*
	(0.09)	(0.08)	(0.13)	(0.12)	(0.09)	(0.07)	(0.14)
Semi-urban	0.16	-0.19	0.10	0.11	0.20**	0.12	0.15
	(0.14)	(0.12)	(0.10)	(0.13)	(0.09)	(0.14)	(0.11)
Island	-0.23	-0.30**	-0.13	-0.50**	0.09	-0.05	-0.22
	(0.25)	(0.14)	(0.09)	(0.24)	(0.20)	(0.04)	(0.19)
Township FEs	✓	✓	✓	✓	✓	✓	✓
Observations	196	196	196	196	196	196	196
R-squared	0.44	0.37	0.47	0.15	0.18	0.09	0.21

Notes: This table examines the relationship between kinship fractionalization (I_i^{Frac}, a dummy for above-median fractionalization) and pre-bridge infrastructure indicators in Namhae County. Columns 1–4 and 6–7 use binary dependent variables (Highway, State Rd., County Rd., Car Access, Water, Electricity). Column 5 uses log(number of schools + 1) as the dependent variable. Standard errors are clustered at the legal village level. All models include township fixed effects to control for unobserved time-invariant geographic characteristics. Village characteristics controls include log(land area), log(number of households), and share of agricultural households. Village type dummies include indicators for fishing/coastal, semi-urban, and island villages, with rural agricultural villages as the baseline.

Table A.29: Fractionalization and Pre-Bridge Infrastructure Indicators

	Road Network				Public Services		
	Highway (1)	State Rd. (2)	County Rd. (3)	Car Access (4)	log(Schools) (5)	Water (6)	Electricity (7)
F_i	0.42	-0.17	-0.44	0.06	-0.00	-0.32	1.26**
	(0.43)	(0.30)	(0.36)	(0.48)	(0.20)	(0.29)	(0.54)
Controls:							
log(land area)	-0.07	-0.16***	0.08*	0.03	0.01	-0.05	0.01
	(0.06)	(0.06)	(0.05)	(0.05)	(0.03)	(0.05)	(0.06)
log(# of hh.)	0.17***	0.13	0.09	0.14	0.18***	0.06	0.11
	(0.06)	(0.08)	(0.07)	(0.10)	(0.05)	(0.05)	(0.09)
Share of agri. hh.	0.20	0.08	0.25	0.24	-0.00	0.14	0.70***
	(0.17)	(0.27)	(0.20)	(0.26)	(0.13)	(0.14)	(0.22)
Village Type:							
Fishing/Coastal	-0.26***	-0.14*	0.10	-0.35***	0.11	0.04	-0.27*
	(0.09)	(0.08)	(0.13)	(0.11)	(0.08)	(0.07)	(0.13)
Semi-urban	0.16	-0.19	0.10	0.11	0.20**	0.12	0.15
	(0.14)	(0.12)	(0.10)	(0.13)	(0.09)	(0.15)	(0.10)
Island	-0.24	-0.31**	-0.16*	-0.51**	0.10	-0.04	-0.20
	(0.26)	(0.14)	(0.09)	(0.24)	(0.20)	(0.04)	(0.20)
Township FEs	✓	✓	✓	✓	✓	✓	✓
Observations	196	196	196	196	196	196	196
R-squared	0.45	0.37	0.47	0.15	0.18	0.10	0.23

Notes: This table examines the relationship between kinship fractionalization (F_i, Herfindahl index of clan concentration) and pre-bridge infrastructure indicators in Namhae County. Higher F_i indicates greater clan concentration (lower fractionalization). Columns 1–4 and 6–7 use binary dependent variables (Highway, State Rd., County Rd., Car Access, Water, Electricity). Column 5 uses log(number of schools + 1) as the dependent variable. Standard errors are clustered at the legal village level. All models include township fixed effects to control for unobserved time-invariant geographic characteristics. Village characteristics controls include log(land area), log(number of households), and share of agricultural households. Village type dummies include indicators for fishing/coastal, semi-urban, and island villages, with rural agricultural villages as the baseline.

Table A.30: Fractionalization and Economic & Socioeconomic Characteristics

	Agricultural Output & Livelihoods				Household Assets & Amenities		
	Rice output per hh. (1969) (1)	Barley output per hh. (1969) (2)	Share of non-agri. hh. (3)	Share of modern roofs (4)	log(cows per hh.) (5)	log(radios per hh.) (6)	Telephone (7)
I_i^{Frac}	-139.87*	-0.12	0.08***	0.03	-0.05***	0.00	0.07
	(75.01)	(0.13)	(0.02)	(0.02)	(0.02)	(0.02)	(0.09)
Controls:							
log(land area)	154.13**	0.13	-0.04**	-0.06***	0.03***	-0.02	-0.05
	(60.23)	(0.10)	(0.02)	(0.02)	(0.01)	(0.02)	(0.08)
log(# of hh.)	-333.87***	-0.68***	0.13***	0.06**	-0.06***	-0.04	0.27***
	(102.26)	(0.23)	(0.03)	(0.03)	(0.02)	(0.03)	(0.08)
Share of agri. hh.	-871.72**	-2.03**		-0.09	0.28***	-0.16**	-0.25
	(400.74)	(0.97)		(0.08)	(0.06)	(0.08)	(0.19)
Village Type:							
Fishing/Coastal	-444.12***	-0.40**	0.10**	-0.01	-0.02	-0.02	0.07
	(104.22)	(0.17)	(0.05)	(0.04)	(0.02)	(0.03)	(0.12)
Semi-urban	-66.29	-0.44*	0.19***	0.07*	-0.02	0.07**	0.08
	(132.52)	(0.22)	(0.06)	(0.04)	(0.02)	(0.04)	(0.12)
Island	-503.36***	-0.49*	0.05	0.04	0.04	0.03	-0.20**
	(149.72)	(0.29)	(0.06)	(0.06)	(0.03)	(0.06)	(0.10)
Township FEs	✓	✓	✓	✓	✓	✓	✓
Observations	196	196	196	196	196	196	196
R-squared	0.36	0.34	0.54	0.40	0.64	0.65	0.36

Notes: This table examines the relationship between kinship fractionalization (I_i^{Frac}, a dummy for above-median fractionalization) and selected pre-bridge economic and socioeconomic characteristics in Namhae County. Columns 1–2 measure agricultural output per household (1969), Columns 3–4 use shares, Columns 5–6 use logarithmic measures, and Column 7 uses a binary dependent variable (Telephone access). Standard errors, in parentheses, are clustered at the legal village level. All models include township fixed effects to control for unobserved time-invariant geographic characteristics. Controls include log(land area), log(number of households), share of agricultural households (omitted in Column 3 due to collinearity), and village type dummies (fishing/coastal, semi-urban, island, with rural agricultural as baseline). Condensed results for these and additional outcomes are in Table A.19.

Table A.31: Full Interaction Estimates: Social Fractionalization, Infrastructure, and Productivity

	Rice Output per Agri. Household			
	(1)	(2)	(3)	(4)
$I_i^{Frac} \times I_i^{Bridge} \times Post_t$	-349.67***	-361.24***	-353.34***	-357.07***
	(128.52)	(127.35)	(127.68)	(127.57)
I_i^{Frac}	189.28*	154.98*	118.72	58.68
	(112.72)	(92.73)	(93.31)	(94.30)
I_i^{Bridge}	-22.36	-260.73	-320.98	-442.34**
	(91.29)	(254.65)	(223.97)	(197.40)
$Post_t$	91.99	102.04	107.09	124.24
	(83.49)	(83.32)	(82.52)	(85.96)
$I_i^{Frac} \times I_i^{Bridge}$	-270.84**	-209.90**	-179.96*	-82.60
	(123.34)	(104.79)	(103.82)	(107.25)
$I_i^{Frac} \times Post_t$	228.25*	233.10**	233.32**	223.82*
	(119.07)	(117.89)	(117.45)	(115.16)
$I_i^{Bridge} \times Post_t$	256.14***	277.49***	270.85***	291.37***
	(89.88)	(87.88)	(87.11)	(86.65)
Mean of Y (Pre-1973)	886.0	886.0	886.0	886.0
Demographic controls	✓	✓	✓	
Socioeconomic/village controls		✓	✓	
Geographic controls			✓	
LASSO				✓
Observations	1,364	1,358	1,358	1,279
R-squared	0.22	0.30	0.32	0.36

Notes: The estimates (1) with demographic controls, and (2) with both demographic and village-level controls, (3) with geographic controls, (4) LASSO-selected controls are presented. The demographic controls include the log of population, the share of agricultural households, the share of the population greater than 14, and the share of women. The socioeconomic/village controls include the age of a village leader, the share of modified roofs, log of the number of schools, car accessibility, access to water, electricity, and phone. The geographic controls include log of total land area, share of land area that is cultivated, and log of distance to the closest public office. Standard errors are clustered at the village level.

Table A.32: The Effect of Social Fractionalization on Barley and Rice Productivity

	Barley Output per Agri. HH (kg)			Rice Baseline
	(1)	(2)	(3)	(4)
$I_i^{Bridge} \times Post_t$	136.13		206.18	188.23**
	(129.81)		(146.70)	(93.72)
$I_i^{Frac} \times Post_t$		-34.68	89.41	234.11**
		(67.61)	(152.00)	(113.29)
$I_i^{Frac} \times I_i^{Bridge} \times Post_t$			-142.86	-352.97***
			(169.35)	(127.68)
Demographic controls	✓	✓	✓	✓
Mean of Y (Pre-1973)	1,208	1,208	1,208	886.0
Observations	1,286	1,286	1,286	1,364
Number of villages	196	196	196	196
R-squared	0.49	0.49	0.49	0.76

Notes: This table presents double-difference estimates (columns 1-2) and the triple-difference specification (column 3) for barley ouput per agricultural household in kg. The baseline result for rice is repeated in column 4 for easy comparison. All specifications include village and year fixed effects, and controls for demographic characteristics: log of total village population, average household size, and share of women in the village population. *** p<0.01, ** p<0.05, * p<0.10.

Table A.33: Robustness to Alternative Fixed Effects

	Rice Output per Agricultural Household (kg)			
	(1)	(2)	(3)	(4)
$I_i^{Frac} \times I_i^{Proximity} \times Post_t$	226.13**	231.14**	228.79***	244.01***
	(91.83)	(97.24)	(83.03)	(80.54)
Fixed Effects:				
Village	✓	✓	✓	✓
Year	✓	✓	✓	✓
Township × Year		✓		
1969 Farmland Area × Year			✓	
1969 Share of Agri. HH. × Year				✓
Demographic controls	✓	✓	✓	✓
Mean of Y (Pre-1973)	886.0	886.0	886.0	886.0
Observations	1,079	1,079	1,073	1,079
Number of villages	170	170	170	170
R-squared	0.81	0.87	0.82	0.83

Notes: This table examines the stability of the triple-difference coefficient across alternative fixed effects specifications. All specifications include controls for demographic characteristics: log of total village population, average household size, and share of women in the village population. Column (1) includes only village and year fixed effects. Column (2) adds township × year fixed effects, absorbing time-varying shocks at the administrative level (25 villages per township on average). Column (3) adds farmland area × year fixed effects, allowing differential trends by initial agricultural capacity. Column (4) uses share of agricultural household in 1969 × year fixed effects, allowing trends to vary by initial specialization in agriculture. Standard errors clustered at the village level in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table A.34: Strategic Crop Specialization Following Bridge Construction: Role of Infrastructure

	Output per Agricultural Household (tons)				$log(Output + 1)$
	(1) Rice	(2) Potatoes	(3) Garlic	(4) Cabbage	(5) Silk
Panel A: Heterogeneity by Feeder Roads (The "Input/Bulk" Channel)					
$I_i^{Bridge} \times Post_t \times RoadStock_{i,t}$	-0.22	-1.68***	0.01	0.01	0.39
	(0.15)	(0.41)	(0.01)	(0.02)	(0.49)
Panel B: Heterogeneity by Market Access (The "Output/Transaction" Channel)					
$I_i^{Bridge} \times Post_t \times MarketProximity_i$	0.06**	0.00	-0.00*	0.04***	-0.01
	(0.03)	(0.02)	(0.00)	(0.01)	(0.09)
Demographic Controls	✓	✓	✓	✓	✓
Village and Year FE	✓	✓	✓	✓	✓
Log(Farmland$_{i,1972}$) $\times$ Year FE	✓	✓	✓	✓	✓
Mean of Dep. Var. (Pre-1973)	0.89	1.47	0.06	0.14	3.57
Observations (Panel A)	608	496	391	391	442
Observations (Panel B)	1,358	1,135	924	924	982

Notes: This table tests how the diversification effect in fractionalized villages is moderated by different types of infrastructure. Each coefficient is from a separate three-way interaction regression. The dependent variable is the output per agricultural household for each crop. Panel A tests the "input/bulk" channel using $RoadStock_i, t$ (cumulative km of new feeder roads). Panel B tests the "output/transaction" channel using $MarketProximity_i$ (distance to the nearest township office where local markets opened). The $RoadStock_i, t$ regressions are run on the smaller, restricted sample for which road data are available. Standard errors, clustered at the village level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.35: The Effect of Bridge Access on Livestock Ownership

	log(Livestock per Agri. HH. $+ 1$)			
	(1)	(2)	(3)	(4)
	Cows	Pigs	Chickens	Rabbits
Panel A: Average Treatment Effect (DiD)				
$I_i^{Bridge} \times Post_t$	0.08***	0.02	-0.01	0.09***
	(0.02)	(0.02)	(0.10)	(0.03)
Panel B: Heterogeneity by Social Fractionalization (DDD)				
$I_i^{Bridge} \times Post_t$ *(Low-Frac. Effect)*	0.11***	-0.01	-0.00	0.10***
	(0.03)	(0.04)	(0.14)	(0.04)
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$	-0.05	0.05	0.01	-0.02
	(0.03)	(0.05)	(0.17)	(0.05)
Demographic Controls	✓	✓	✓	✓
Village and Year FEs	✓	✓	✓	✓
Log(Farmland$_{i,1972}$) $\times$ Year FE	✓	✓	✓	✓
Mean of Y (Pre-1973)	0.48	0.30	8.20	0.27
Observations	1,364	1,364	1,364	1,364
Number of Villages	196	196	196	196

Notes: This table presents the effect of bridge access on livestock ownership per agricultural household using administrative data from *Namhae County Statistical Yearbooks*. All specifications include village and year fixed effects, as well as interactions between year fixed effects and log(1972 farmland area). Demographic controls include the log of total village farmland, average household size, and share of women. The triple-interaction terms in Panel B are not statistically significant, suggesting that cohesive and fractionalized villages did not differ in their livestock investment responses to bridge access. Standard errors, clustered at the village level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.36: The Effect of Bridge Access on Media Access

	log(Number per HH. + 1)		
	(1) Newspapers	(2) TVs	(3) Radios
Panel A: Average Treatment Effect (DiD)			
$I_i^{Bridge} \times Post_t$	-0.02**	0.00	0.11***
	(0.01)	(0.01)	(0.02)
Panel B: Heterogeneity by Social Fractionalization (DDD)			
$I_i^{Bridge} \times Post_t$ *(Low-Frac. Effect)*	-0.02**	0.01	0.13***
	(0.01)	(0.01)	(0.03)
$I_i^{Bridge} \times Post_t \times I_i^{Frac}$	0.02	0.00	-0.04
	(0.02)	(0.02)	(0.04)
Demographic Controls	✓	✓	✓
Village and Year FEs	✓	✓	✓
Log(Farmland$_{i,1972}$) × Year FE	✓	✓	✓
Mean of Y (Pre-1973)	0.09	0.0009	0.35
Observations	1,285	1,285	1,285
Number of Villages	196	196	196

Notes: This table presents the effect of bridge access on media access per household using administrative data from *Namhae County Statistical Yearbooks*. The dependent variable is log(media items per household + 1) for all village households, as media access is relevant for both agricultural and non-agricultural economic activities. All specifications include village and year fixed effects, as well as interactions between year fixed effects and log(1972 farmland area). Demographic controls include the log of total village farmland, average household size, and share of women. The sample is smaller than the main analysis (1,285 vs. 1,364) due to missing media data for some years. Panel A shows the average effect from a DiD model. Panel B shows heterogeneous effects from a DDD model. While bridge access affected media adoption overall (Panel A), the triple-interaction terms in Panel B are not statistically significant, suggesting that cohesive and fractionalized villages did not differ in their media adoption responses to bridge access. Standard errors, clustered at the village level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.