Can High-speed Rail Improve Middle-aged and Elderly People's Mental Health? Evidence from China
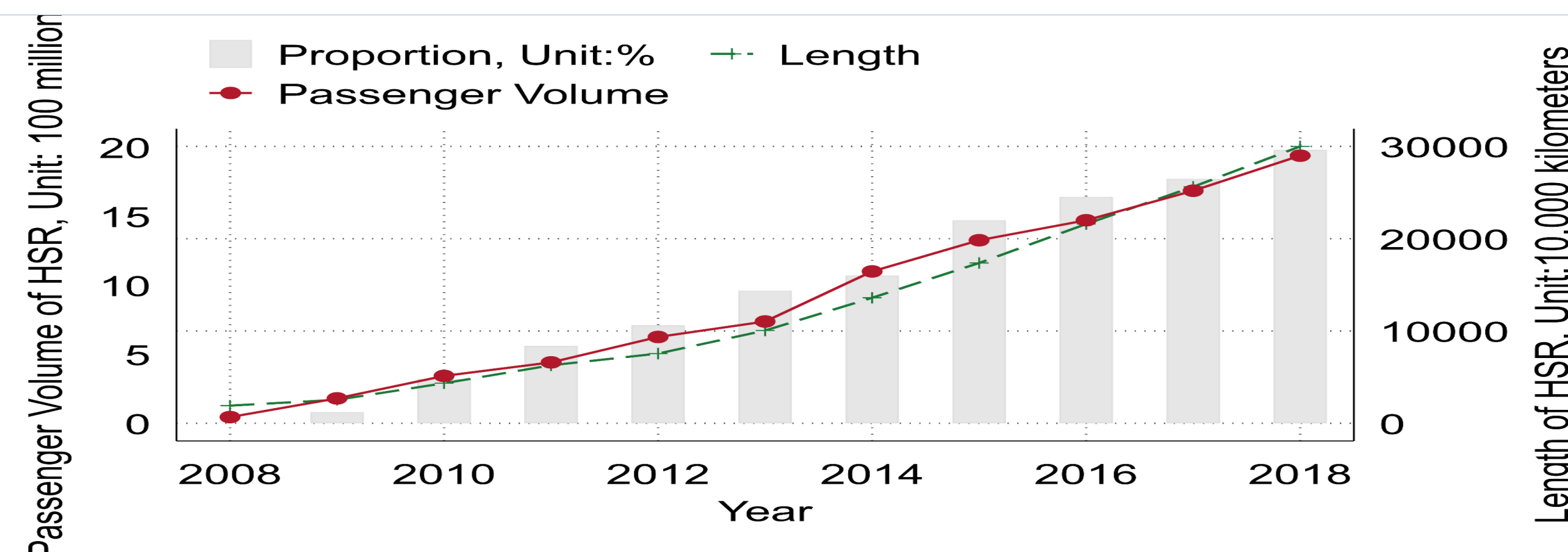
Yushang Wei, University at Buffalo (SUNY) , Department of Economics
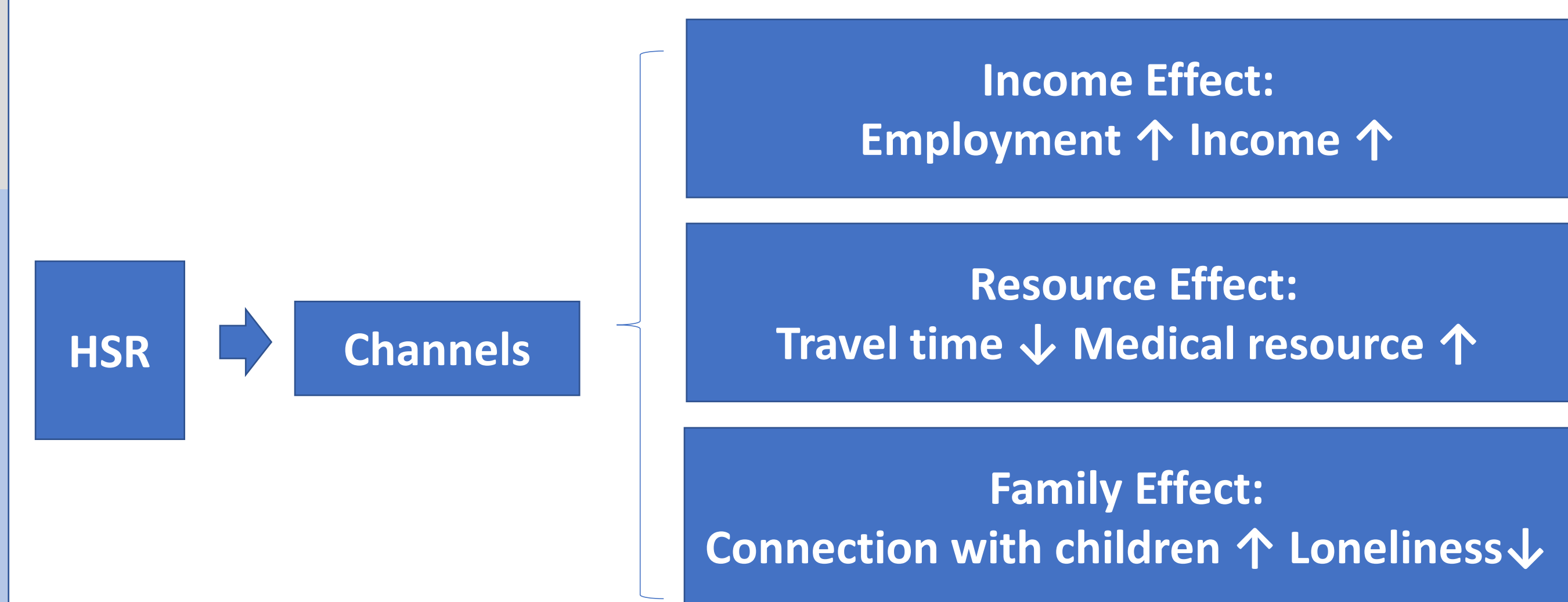
Abstract

- This paper studies the effects of high-speed rail service on the mental health of middle-aged and elderly people aged 45 years or older. I use historical documents and ArcGIS Pro to restore and produce the railway map in the late Qing Dynasty (1911) as an instrument for modern high-speed rail networks in China. I find that high-speed rail service significantly increases the mental health of middle-aged and elderly people. The paper also examines the mechanisms through which high-speed rail improves the mental health of middle-aged and elderly people. In particular, the findings suggest that high-speed rail could increase meeting frequency with their children, which reduces loneliness. Contrasted with rural residents, the introduction of high-speed rail services has a relatively stronger impact on the mental health of urban residents.

Introduction

- China has placed a high priority on transportation infrastructure, especially **high-speed railway (HSR).** Assessing the impact of HSR on the socioeconomic landscape has always been a significant area of interest for policymakers and researchers. Due to the high and irreversible costs of operating HSR, **it is essential to estimate whether HSR can bring sufficient economic benefits.**
- **China's aging population is a significant threat to its future**. The Chinese government has made significant efforts to address the health needs of its aging population and improve elderly care services. However, the healthcare coverage for mental health may not be as comprehensive as the coverage for physical health. Hence, it is important for the Chinese government to emphasize the mental health of the relatively old population.
- The HSR and health related estimation results encompass all age groups and primarily concentrate on physical health concerns. The specific analysis that targets the middle-aged and elderly group is unclear, and the influence on mental health is also restricted. **As a result, this study addresses these limitations and examines the significant and positive impact of HSR's inauguration on the mental health of individuals aged above 45.**

Channels of Causality

HSR → Channels

- **Income Effect:** Employment ↑ Income ↑
- **Resource Effect:** Travel time ↓ Medical resource ↑
- **Family Effect:** Connection with children ↑ Loneliness↓

Identification Strategy

- **Instrumental variables (IV) approach: Distance to the railway at end of Qing Dynasty**
  - ➤ **The basic idea** is that cities in close proximity to railways during the late Qing Dynasty are more likely to have HSR services in present times. The IV approach relies on the assumption that the instrument is correlated with the causal variable of interest(HSR) but uncorrelated with any other determinants of the dependent variable(mental score).

  - ➤ **Validity of the Instrumental Variable :**   Prior to the Revolution of 1911, China was ruled by the Qing dynasty and experienced a series of conflicts with foreign powers. These foreign powers invaded China and forced it to sign unequal treaties, granting them various benefits and rights on Chinese territory, including the construction of railways. Around The unique history of China provides a basis for the instrument's exogeneity.

  - ➤ **IV Estimation Equation:**

  First Stage:
  $$hsr_c \times post_t = \rho Dist1911_c \times post_t + \pi X'_{ict} + \eta Z'_{ct} + \delta_c + \theta_t + \epsilon_{ict}$$

  Second Stage:
  $$Mental_{ict} = \beta\, \widehat{hsr_c \times post_t} + \gamma X'_{ict} + \alpha Z'_{ct} + \delta_c + \theta_t + \epsilon_{ict}$$

Main Results

Dependent Variable: Mental	All Samples				Excluding Provincial Capitals			
	OLS	IV	Reduced-form	First-stage	OLS	IV	Reduced-form	First-stage
β	0.456**	1.499***			0.381*	1.910***		
	(0.195)	(0.506)			(0.213)	(0.602)		
log(distance to rail in 1911)*post			-0.191***	-0.128***			-0.221***	-0.116***
			(0.065)	(0.028)			(0.067)	(0.030)
City and year FE	✓	✓	✓	✓	✓	✓	✓	✓
Individual & City controls	✓	✓	✓	✓	✓	✓	✓	✓
Observations	44,424	44,424	44,424	44,424	38,275	38,275	38,275	38,275
First-stage effective F-statistic			16.670				11.479	
AR weak IV robust test(P-vale)			0.003				0.0009	

Income and Resource Effect

Dependent Variable:	Employment		Inpatient care(another city)	
	OLS	IV	OLS	IV
	0.047*	0.117	0.057***	0.095***
	(0.017)	(0.027)	(0.020)	(0.023)
City and year FE	✓	✓	✓	✓
Individual & City controls	✓	✓	✓	✓
Observations	21,414	21,414	5,055	5,055
First-stage effective F-statistic		21.396		6.812
AR weak IV robust test(p-value)		0.1473		0.0456

## Family Effect

Dependent Variable:	Samples: Children living in another city				Samples: Children living in same city or abroad			
	Meeting Frequency		Contact Frequency		Meeting Frequency		Contact Frequency	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	0.413	2.400**	0.153	1.574	-0.176	-0.124	-0.097	-0.109
	(0.289)	(1.160)	(0.296)	(1.195)	(0.396)	(0.766)	(0.633)	(1.628)
City and year FE	✓	✓	✓	✓	✓	✓	✓	✓
Individual & City controls	✓	✓	✓	✓	✓	✓	✓	✓
Observations	5,574	5,574	5,808	5,808	5,357	5,357	7,294	7,294
First-stage effective F-statistic		7.480		7.101		37.739		37.712
AR weak IV robust test(p-value)		0.0112		0.1631		0.8710		0.9462

Map: Railway in Qing Dynasty
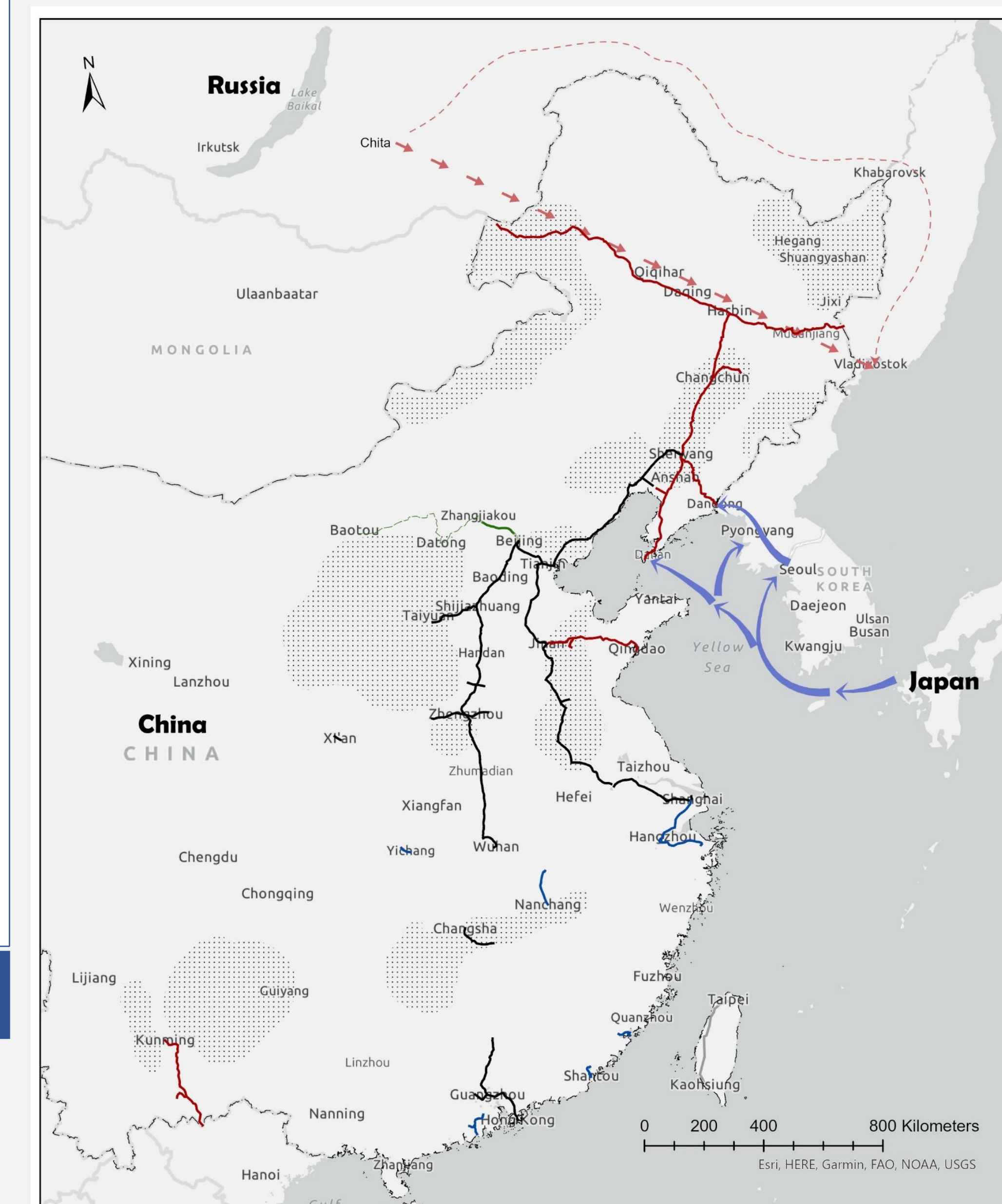
Log(distance to railway in 1911) by treatment
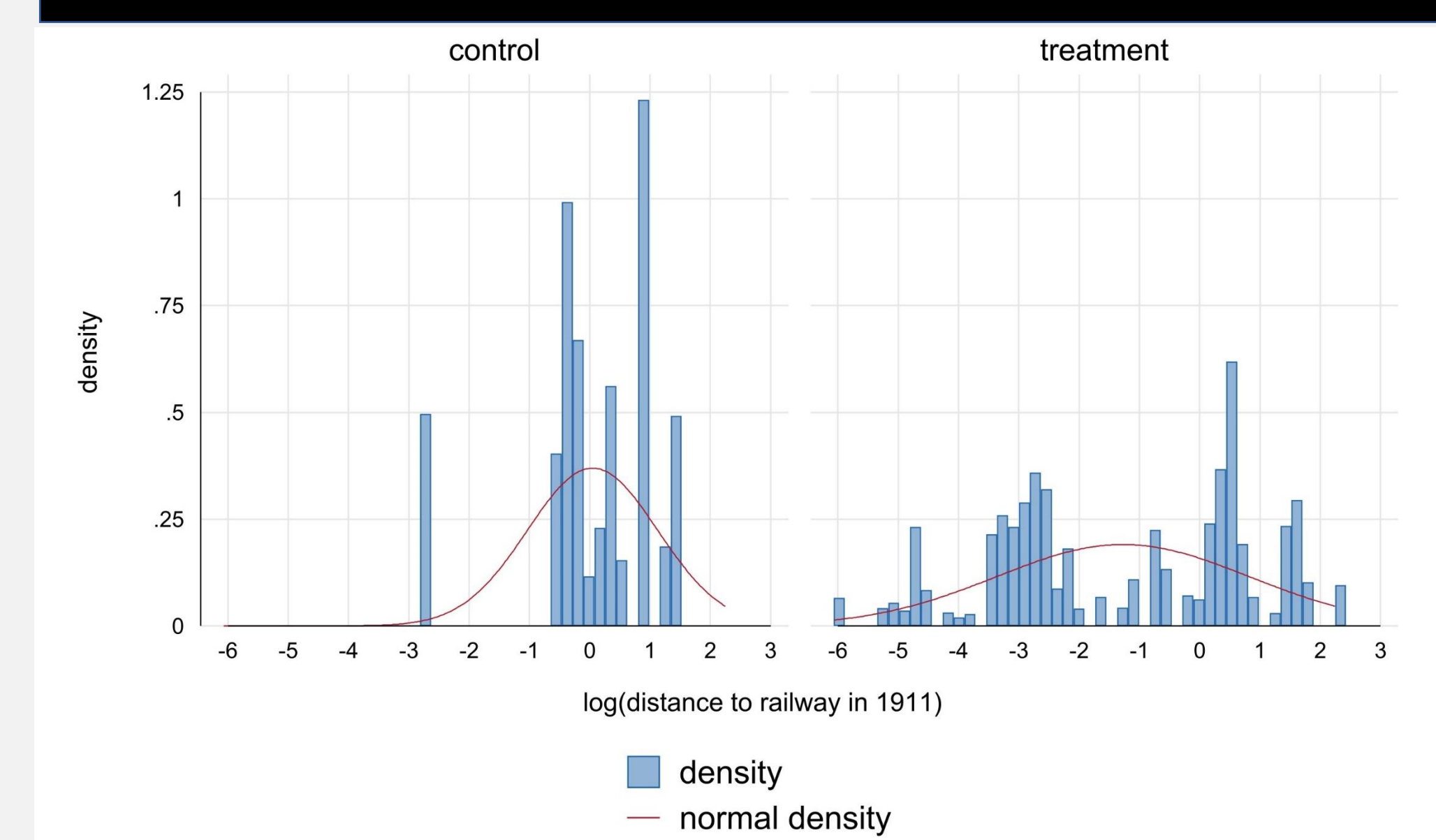
Discussion

This study focuses on the impact of HSR on the mental health of middle-aged and elderly individuals in China, the findings and implications may have broader relevance beyond China's context. Exploring the experiences of other countries at different stages of economic development can provide valuable insights into the unintended consequences of HSR on mental health outcomes. Therefore, future research efforts that investigate the impact of HSR on mental health in various countries and contexts can contribute to the broader knowledge base and inform evidence-based policies in the transportation and public health sectors.