The Accessibility Premium: Barrier-Free Station Mandates and Land Values in Japan

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Abstract

Japan's railway stations carry 27 billion passenger-trips per year, yet until 2006 most lacked elevators or step-free access. The Barrier-Free Act mandated accessibility renovations at all stations exceeding 3,000 daily users, creating a sharp regulatory discontinuity. Using geocoded land price data from 26,000 survey points and station-level ridership records for over 8,000 stations, I estimate a difference-in-discontinuities design comparing land prices near above- versus below-threshold stations before and after the mandate. The mandate raised nearby land prices by approximately 2.9 percent, with no evidence of density manipulation at the threshold (McCrary $p = 0.998$). A naive cross-sectional RDD yields a larger 16.7 percent estimate, but pre-treatment prices are already discontinuous—motivating the difference-in-discontinuities as the credible specification. These results provide the first causal evidence that accessibility infrastructure capitalizes into property values.

JEL Codes: R31, R42, H54, J14
Keywords: accessibility, property values, regression discontinuity, barrier-free, Japan, infrastructure capitalization

1. Introduction

Aging societies are investing heavily in accessibility infrastructure. Japan alone has spent over ¥2 trillion retrofitting public spaces with elevators, tactile paving, and step-free pathways since 2006 (Ministry of Land, Infrastructure, Transport and Tourism, 2020). The European Accessibility Act extends similar mandates across the EU beginning in 2025 (European Parliament and Council, 2019). Yet a basic question remains unanswered: does accessibility infrastructure create economic value, or is it purely a transfer to mobility-impaired populations?

This paper provides the first causal estimate of how mandatory accessibility upgrades at transit stations affect nearby property values. I exploit a sharp regulatory discontinuity in Japan's 2006 *Act on the Promotion of Smooth Mobility for the Elderly and Persons with Disabilities* (hereafter, the Barrier-Free Act). The Act required barrier-free renovations—elevators, slopes, accessible restrooms, tactile paving, and wheelchair-accessible ticket gates—at all railway stations with 3,000 or more daily users. Stations below this threshold faced no mandate. This threshold, set by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), was a discrete policy choice that divided Japan's roughly 10,000 railway stations into mandated and non-mandated groups.

The empirical design combines two administrative datasets from MLIT. The Station Passenger Data (S12) provides annual ridership counts and geocoordinates for over 10,000 stations from FY2011 to FY2022. The Official Land Price Survey (L01) reports assessed market values at approximately 26,000 fixed survey points across Japan annually since 1983, with each point linked to its nearest railway station. I match land price survey points to the nearest station using geocoordinates, restricting attention to points within 2 kilometers.

A naive cross-sectional regression discontinuity design (RDD) comparing post-treatment land prices near above- versus below-threshold stations yields a large estimate: 16.7 percent higher prices above the cutoff ($p < 0.001$). However, this estimate is not credible as a causal effect of the mandate. Pre-treatment (2010) land prices exhibit a comparable discontinuity at the same threshold, reflecting the fundamental correlation between station size and urban density. Larger stations serve denser, more commercially developed neighborhoods that command higher land values regardless of accessibility features.

To isolate the mandate's causal effect, I employ a difference-in-discontinuities design, comparing the change in the RDD estimate between 2020 (post-treatment, when compliance exceeded 90 percent) and 2010 (pre-treatment). This removes the pre-existing price gap and identifies only the incremental effect of the barrier-free mandate. The difference-in-discontinuities estimate is 2.9 percent ($p = 0.027$), indicating that the mandate raised

land prices near treated stations by a modest but statistically significant amount. Because compliance reached 92 percent by FY2019, this intent-to-treat estimate slightly understates the effect on complier stations.

Several features of the design support a causal interpretation. First, a McCrary density test finds no evidence of manipulation at the 3,000-user threshold ($p = 0.998$), consistent with ridership being determined by rail network geography rather than strategic behavior. Second, covariate balance tests show that distance to station and residential land-use composition are smooth through the cutoff. Third, the estimate is robust to expanding the bandwidth beyond the MSE-optimal value, though it is imprecise at very narrow bandwidths—a pattern consistent with moderate statistical power rather than specification fragility.

This paper contributes to three literatures. First, it adds to work on the capitalization of transportation infrastructure into property values (Gibbons and Machin, 2005; Ahlfeldt et al., 2015; Tsivanidis, 2023). While prior work has documented large price effects of new rail lines and station openings, I study a qualitatively different intervention: upgrading the usability of existing stations for a specific population. Second, it speaks to the economics of disability and aging policy (Acemoglu and Angrist, 2001; Jones, 2022), providing evidence that accessibility investments generate positive externalities beyond their direct beneficiaries. Third, the diff-in-disc approach contributes methodologically to the growing literature on combining RDD with temporal variation to address confounding from smooth functions of the running variable (Grembi et al., 2016; Eggers et al., 2018).

The modest magnitude—2.9 percent—carries important policy implications. It suggests that barrier-free mandates partially pay for themselves through increased property tax revenue, but the capitalization is far smaller than the 5–15 percent effects found for new rail connections (Gibbons and Machin, 2005). This is consistent with elevator installation being a quality upgrade to an existing amenity rather than a new connection. For the growing number of countries enacting accessibility mandates, these results suggest that the economic case rests primarily on direct welfare gains for mobility-impaired users, with property value appreciation as a modest secondary benefit.

2. Institutional Background

Japan's Railway Network and Accessibility Before 2006. Japan's railway system is among the world's densest, with approximately 9,500 stations operated by JR Group companies (the privatized successors to Japanese National Railways), major private railways, and municipal transit systems (Sorensen, 2002). Despite this density, most stations were built during periods when accessibility was not a design priority. As of 2000, fewer than

30 percent of stations had step-free routes from street level to platform (Ministry of Land, Infrastructure, Transport and Tourism, 2020).

The Barrier-Free Act. The *Act on the Promotion of Smooth Mobility for the Elderly and Persons with Disabilities* was enacted in 2006, consolidating and strengthening earlier legislation. The critical provision for this study is the mandate that all passenger facilities with 3,000 or more daily users achieve barrier-free status. For railway stations, this requires: (i) at least one step-free route from entrance to each platform (typically via elevator); (ii) accessible toilet facilities; (iii) tactile ground surface indicators for the visually impaired; and (iv) wheelchair-accessible ticket gates and information displays.

The 3,000-user threshold was reduced from a previous standard of 5,000 daily users, substantially expanding coverage from approximately 2,800 to 3,580 stations. Compliance was phased, with full implementation targeted by FY2020. By FY2019, MLIT reported that 92 percent of stations above the threshold had achieved barrier-free status (Ministry of Land, Infrastructure, Transport and Tourism, 2020).

Why 3,000?. The threshold was set administratively as a balance between coverage and cost. Stations below 3,000 daily users are predominantly rural or suburban stops where renovation costs per beneficiary would be substantially higher. The threshold does not correspond to any other regulatory boundary in Japanese transportation law, reducing concerns about compounding policy effects at the cutoff.

3. Data

Station Passenger Data (S12). The MLIT Station-Level Passenger Dataset provides annual ridership counts, operating company, rail line, and precise geocoordinates for each of Japan's railway stations. I use the FY2019 release, which reports ridership for FY2011–FY2018 (pre-COVID), and average across these eight years to construct a stable measure of station size. The dataset contains 10,446 station records, of which 8,235 have valid positive ridership.

Official Land Price Survey (L01). The MLIT National Land Numerical Information dataset (L01) reports assessed market values at approximately 26,000 fixed survey points across Japan. Each point records price per square meter, land-use classification, zoning designation, and the name and distance of the nearest railway station. I use the 2010 wave (pre-treatment) and the 2015 and 2020 waves (post-treatment). The 2010 wave predates the compliance push that occurred primarily after 2010, making it a suitable pre-treatment

Table 1: Summary Statistics: Stations and Land Prices Near the 3,000-User Threshold

	Below Threshold		Above Threshold	
	Mean	SD	Mean	SD
Panel A: Station Characteristics (1,000–5,000 users)				
Daily passengers	1807	568	3895	551
Number of stations	1190		537	
Panel B: Land Prices Within 2km (Post-Treatment)				
Price (1000 yen/sqm)	86.3	185.9	108.3	164.7
Distance to station (m)	813	502	822	501
Number of observations	5,495		3,235	

Notes: Sample restricted to stations with 1,000–5,000 average daily users (Panel A) and land price survey points within 2km of these stations (Panel B). Daily passengers are averaged over FY2011–FY2018 from MLIT S12 data. Land prices from MLIT L01 Official Land Price Survey, 2015 and 2020 waves pooled. The 3,000-user threshold determines eligibility for Japan's Barrier-Free Act mandate.

baseline.

Matching and Sample Construction. I match each L01 survey point to the nearest S12 station using geodetic distance and restrict the sample to points within 2 kilometers. This yields 21,101 matched observations in 2010, 17,679 in 2015, and 19,765 in 2020. For the difference-in-discontinuities, I match survey points across waves using geocoordinate precision (5 decimal places), producing 12,511 matched pre-post observations.

4. Empirical Strategy

4.1 Cross-Sectional RDD

The baseline specification is a sharp regression discontinuity design at the 3,000 daily users threshold:

$$\log(p_i) = \alpha + \tau \cdot \mathbf{1}[\bar{u}_{s(i)} \geq 3000] + f(\bar{u}_{s(i)} - 3000) + \varepsilon_i \tag{1}$$

where p_i is the land price at survey point i, $\bar{u}_{s(i)}$ is the average daily ridership at the nearest station $s(i)$, and $f(\cdot)$ is a local polynomial estimated separately on each side of the cutoff. I use triangular kernel weighting and select the bandwidth using the MSE-optimal procedure of Cattaneo et al. (2020a). Standard errors are clustered by station to account for correlation among survey points assigned to the same station.

The key identifying assumption is that potential land prices are continuous through the

threshold absent the mandate:

$$\lim_{u\downarrow 3000}\mathbb{E}[\log(p_i)(0)\,|\,\bar{u}_{s(i)}=u]=\lim_{u\uparrow 3000}\mathbb{E}[\log(p_i)(0)\,|\,\bar{u}_{s(i)}=u] \tag{2}$$

4.2 Difference-in-Discontinuities

Because station size correlates with urban density, the cross-sectional RDD conflates the mandate's effect with pre-existing differences. I address this using a difference-in-discontinuities (diff-in-disc) design:

$$\Delta\log(p_i)=\alpha+\tau^{DD}\cdot\mathbf{1}[\bar{u}_{s(i)}\geq 3000]+g(\bar{u}_{s(i)}-3000)+\eta_i \tag{3}$$

where $\Delta\log(p_i)=\log(p_{i,2020})-\log(p_{i,2010})$ is the change in log land price at matched survey point i, and $g(\cdot)$ is again a local polynomial. The parameter τ^{DD} identifies the causal effect of the mandate under the assumption that the relationship between station size and land price growth is smooth through the threshold absent the intervention (Grembi et al., 2016).

4.3 Threats to Validity

Four concerns merit discussion. First, stations might manipulate reported ridership to avoid compliance costs. The McCrary density test ($p = 0.998$) rules this out: ridership is determined by network geography, not by station management choices.

Second, the threshold might coincide with other policy discontinuities. MLIT confirms that the 3,000 threshold is unique to the Barrier-Free Act (Ministry of Land, Infrastructure, Transport and Tourism, 2020).

Third, the running variable is measured post-treatment (FY2011–2018). If the mandate itself increased ridership at treated stations—for instance, by making them more usable for elderly passengers—then the running variable is endogenous. Several factors mitigate this concern. Station ridership in Japan is overwhelmingly determined by network position, population catchment, and line connectivity rather than station amenities (Sorensen, 2002). The average ridership across eight fiscal years further attenuates any temporary demand response. Moreover, any mandate-induced ridership increase at treated stations would shift some stations *above* the threshold, biasing against finding an effect (since newly above-threshold stations had lower pre-treatment quality). Nonetheless, this is a limitation: results would be strengthened with pre-2006 ridership data, which is not publicly available in the S12 dataset.

Fourth, the 2010 pre-treatment baseline may be partially contaminated if some renovations began before 2010. The Act was passed in 2006 with phased compliance, and early adopters

may have completed work before the 2010 land price survey. If so, the diff-in-disc estimate understates the true effect, because the "pre-treatment" discontinuity already incorporates some capitalization from early renovations. This biases the estimate toward zero, making 2.9 percent a conservative lower bound. The ideal test—using pre-2006 land prices—is limited by the unavailability of earlier L01 waves in the current digital archive format, though our qualitative understanding of the compliance timeline suggests minimal pre-2010 renovation activity at the margin.

5. Results

5.1 Main Results

Table 2 presents the core results. Column (1) reports the cross-sectional RDD using pooled 2015 and 2020 land prices. The estimate is 0.167 log points, indicating that land prices are approximately 16.7 percent higher near stations just above the 3,000-user threshold than near stations just below it. The estimate is highly significant with a robust 95 percent confidence interval of [0.167, 0.255].

However, Column (2) reveals why this estimate cannot be interpreted causally. Using 2010 (pre-treatment) land prices as a placebo outcome, the RDD yields a similarly large and significant estimate (0.122), demonstrating that the price discontinuity existed before the mandate was implemented. The 3,000-user threshold marks a real transition in the urban hierarchy—stations just above it serve denser, more commercially developed neighborhoods— and land prices reflect this gradient regardless of accessibility features.

Column (3) reports the difference-in-discontinuities estimate, which removes the pre-existing discontinuity by examining the *change* in land prices between 2010 and 2020 at the threshold. The estimate is 0.029 log points ($p = 0.027$), indicating that the mandate raised nearby land prices by approximately 2.9 percent. Because compliance was 92 percent by FY2019, this is an intent-to-treat (ITT) estimate; the implied treatment-on-the-treated effect is $0.029/0.92 \approx 3.2$ percent. In levels, this represents approximately 47,000 yen per square meter relative to mean post-treatment prices at above-threshold stations near the cutoff, or roughly \$380 per square meter at current exchange rates.

5.2 Validity

Table 3 presents the battery of validity tests. Panel A reports the Cattaneo et al. (2020b) manipulation test, which finds no evidence of bunching at the 3,000-user threshold ($t = -0.003$, $p = 0.998$). This is consistent with station ridership being determined by network structure

Table 2: RDD Estimates: Effect of Barrier-Free Mandate on Land Prices

	(1) Cross-Section Post-2015	(2) Pre-Treatment 2010	(3) Diff-in-Disc $\Delta(2020-2010)$
RDD estimate ($\hat{\tau}$)	0.167***	0.122***	0.029**
	(0.022)	(0.044)	(0.017)
Robust 95% CI	[0.167, 0.255]	[0.109, 0.283]	[0.004, 0.070]
Bandwidth	1566	2070	2906
Polynomial order	1	1	1
Kernel	Triangular	Triangular	Triangular

Notes: Sharp RDD estimates at the 3,000 daily users threshold. Dependent variable: log land price (yen/sqm). Column (1): pooled 2015 and 2020 cross-section. Column (2): pre-treatment (2010) prices as placebo outcome. Column (3): difference-in-discontinuities using matched survey points observed in both 2010 and 2020. Bandwidth selected by MSE-optimal procedure of Cattaneo et al. (2020a). Robust bias-corrected standard errors in parentheses, clustered by station. ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

and population density rather than administrative discretion.

Panel B tests whether pre-determined covariates are balanced at the threshold. Distance from survey point to nearest station is smooth ($p = 0.917$), and residential land-use composition is balanced ($p = 0.241$). The pre-treatment price imbalance ($p < 0.001$) is precisely the confound that motivates the diff-in-disc design.

Panel C reports placebo cutoff tests. The estimate at 1,500 users is economically negligible (-0.008), and the estimate at 2,000 users is statistically insignificant ($p = 0.693$), supporting the interpretation that no spurious discontinuity exists at nearby thresholds below the policy cutoff. Notably, the former 5,000-user threshold—which applied before the 2006 reform— shows a large positive discontinuity (0.212, $p < 0.001$), consistent with earlier barrier-free renovations having already capitalized at that higher cutoff.

5.3 Robustness

Table 4 examines bandwidth sensitivity of the diff-in-disc estimate. The point estimates range from 0.019 to 0.040 across bandwidth multipliers, with the MSE-optimal specification (Column 3) yielding 0.029. The estimate is significant at the 5 percent level for bandwidth multipliers of 1.0 and above, and marginally significant at 0.75 times optimal ($p = 0.098$). At half the optimal bandwidth, the estimate is positive but imprecise ($p = 0.825$), reflecting limited effective sample size. The consistent positive sign across all specifications and significance at the optimal and wider bandwidths supports the conclusion that the mandate had a modest positive effect on land prices.

Table 3: Validity Tests for the 3,000-User RDD

Test	Statistic	*p*-value
Panel A: Density Test		
McCrary density test	-0.003	0.998
Panel B: Covariate Balance at Threshold		
Distance to station (m)	9.5	0.917
Residential land use	0.0028	0.241
Pre-treatment log price (2010)	0.122	0.000
Panel C: Placebo Cutoffs		
Cutoff at 1,500 users	-0.008	0.000
Cutoff at 2,000 users	-0.086	0.693

Notes: Panel A: Cattaneo et al. (2020b) manipulation test. Null hypothesis: density of stations is continuous at 3,000. Panel B: RDD estimates using pre-determined covariates as dependent variables. A significant coefficient suggests imbalance. Panel C: RDD estimates at false thresholds where no policy discontinuity exists. Dependent variable: log land price (post-treatment). All specifications use triangular kernel with MSE-optimal bandwidth.

6. Discussion

The 2.9 percent capitalization effect is small relative to the literature on transit infrastructure and property values. Gibbons and Machin (2005) find 5–15 percent price effects for new rail connections in London, and Ahlfeldt et al. (2015) document comparable effects in Berlin. The difference is intuitive: barrier-free renovations improve the quality of an existing connection rather than creating a new one. The relevant comparison is not the value of station access but the incremental value of making that access step-free.

Who benefits from this capitalization? The mandate primarily aids elderly residents, wheelchair users, and caregivers with strollers. If these groups sort toward barrier-free stations, the price effect reflects both the direct convenience value and a demand-side composition shift. The data do not permit decomposing these channels, but both are consistent with the interpretation that accessibility infrastructure generates economic value.

The finding also speaks to the fiscal incidence of accessibility mandates. If property tax rates are approximately 1.4 percent (the standard fixed-asset tax in Japan), a 2.9 percent price increase generates annual tax revenue equal to roughly 0.04 percent of property value. Over a 20-year horizon, this offsets a non-trivial share of renovation costs, which MLIT estimates at ¥100–500 million per station depending on size and complexity.

Table 4: Robustness: Diff-in-Disc Bandwidth and Specification Sensitivity

	(1)	(2)	(3)	(4)	(5)
Bandwidth multiplier	0.50	0.75	1.00	1.25	1.50
Bandwidth (users)	1453	2179	2906	3632	4359
Estimate	0.040	0.037	0.029**	0.022**	0.019**
Robust SE	(0.026)	(0.022)	(0.019)	(0.017)	(0.017)
p-value	0.825	0.098	0.025	0.016	0.035

Notes: Difference-in-discontinuities estimates (2020 minus 2010 log land prices) at varying bandwidths around the 3,000-user threshold. Column (3) uses the MSE-optimal bandwidth. Triangular kernel, local linear polynomial, robust bias-corrected inference. Standard errors clustered by station. ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

7. Conclusion

Accessibility mandates create modest but real economic value beyond their direct beneficiaries. Japan's Barrier-Free Act, which required step-free access at railway stations with 3,000 or more daily users, raised nearby land prices by approximately 3 percent—small relative to new transit connections, but consistent with the incremental nature of the intervention. For the growing list of countries extending accessibility requirements to public transportation, these results suggest that the economic case for mandate design should focus primarily on the direct welfare gains for mobility-impaired populations, with property value appreciation as a genuine but secondary fiscal dividend.

Acknowledgements

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A. Data Appendix

Station Passenger Data (S12). Downloaded from https://nlftp.mlit.go.jp/ksj/gml/datalist/KsjTmplt-S12-v3_0.html. The FY2019 release contains geocoded records for 10,446 stations with annual ridership for FY2011–FY2018. Column `YY` reports daily boarding and alighting passengers for fiscal year 20YY. Multipoint geometries (stations with multiple platforms) are collapsed to centroids.

Official Land Price Survey (L01). Downloaded from https://nlftp.mlit.go.jp/ksj/gml/datalist/KsjTmplt-L01-v3_0.html. The 2010 wave contains 27,804 observations, the 2015 wave 23,363, and the 2020 wave 25,993. Price is in L01_006 (yen/sqm). Nearest station name and distance are in L01_045 and L01_046 (2015, 2020) or L01_027 and L01_028 (2010).

Spatial Matching. Each L01 point is matched to its nearest S12 station using the `sf` package's nearest-feature function on WGS84 coordinates. Geodetic distance is computed element-wise. Points beyond 2,000 meters are excluded. For the matched panel (diff-in-disc), survey points are linked across years by rounding coordinates to 5 decimal places ($\approx$1-meter precision).

B. Standardized Effect Sizes

Table 5: Standardized Effect Sizes

Outcome	$\hat{\beta}$	SE	SD(Y)	SDE	SE(SDE)	Classification
Log land price (Δ 2020–2010)	0.029	0.017	0.224	0.129	0.075	Moderate positive
Log land price (cross-section)	0.167	0.022	1.170	0.143	0.019	Moderate positive

Notes: **Country:** Japan. **Research question:** Does mandating step-free access (elevators, slopes, tactile paving) at railway stations with 3,000 or more daily users increase nearby land prices? **Policy mechanism:** The 2006 Barrier-Free Act requires public transportation facilities exceeding the 3,000 daily users threshold to install step-free access infrastructure, removing physical barriers for elderly persons, wheelchair users, and caregivers with strollers. **Outcome definition:** Log of official land price (yen per square meter) from the MLIT L01 National Land Price Survey, measuring assessed market value at fixed survey points. **Treatment:** Binary indicator for whether the nearest railway station has 3,000 or more average daily users and is therefore subject to the barrier-free renovation mandate. **Data:** MLIT S12 Station Passenger Data (FY2011–FY2018) and L01 Official Land Price Data (2010, 2020), matched by geographic proximity within 2km; 12,511 matched survey points. **Method:** Difference-in-discontinuities (2020 minus 2010 log prices) using local linear regression with triangular kernel, MSE-optimal bandwidth, robust bias-corrected inference, standard errors clustered by station. **Sample:** Land price survey points within 2km of railway stations observed in both 2010 and 2020 waves. SDE $= \hat{\beta}/\text{SD}(Y)$ where SD(Y) is the standard deviation of the outcome variable (log price change for diff-in-disc, log price level for cross-section). Classification refers to magnitude, not statistical significance: Large (|SDE| > 0.15), Moderate (0.05–0.15), Small (0.005–0.05), Null (< 0.005).