Are City Centers Losing Their Appeal?
Commercial Real Estate, Urban Spatial Structure, and Covid-19

Stuart Rosenthal
Syracuse University

William C. Strange
University of Toronto

Joaquin A. Urrego
Syracuse University

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Introduction

- This paper considers how the COVID-19 shock has affected cities.
- In order to do so, we obtain some pre-COVID results that speak to the more general issues of agglomeration and urban spatial structure.
- The paper will also have implications for commercial real estate (CRE), a really important and not very well-understood asset class.

Why do cities exist?

- Because density is valuable
  - Natural advantage: good locations.
  - Internal scale economies: factory towns.
  - External scale economies / agglomeration economies.

- The same forces explain why we have agglomeration within cities into central business districts (CBDs).

- Equilibrium agglomeration depends on the tradeoff between the benefits of agglomeration and the costs

COVID-19

- COVID-19 changes the agglomeration cost-benefit calculus
- Increased costs: disease cost, ventilation, elevators, subways. It is hard to physically distance in an office or retail setting.
- Decreased benefits: empty offices and social distance restrictions reduce interaction; working-from-home has become a viable alternative
- This leads to the big COVID-19 question…

Are city centers losing their attraction to businesses because of COVID-19?

Our approach to answering the big question

- Focus on commercial establishments in the retail and office sectors

- We estimate three spatial patterns of rent within cities that address the following questions:
  - How quickly do commercial rents decline with distance to the city center (i.e, commercial rent gradients)?
  - How much higher are commercial rents in high employment density locations?
  - How quickly do commercial rents decline with distance to a rapid transit station (e.g., a subway stop)?

Has COVID-19 affected the answers to these questions?

Results preview: Pre-COVID

- Results different between “transit” and “car” cities.
- Downward sloping commercial rent functions, steeper for transit cities.
- Employment density rent premium, larger for transit cities
- Transit station proximity premium.
- All of these show the value assigned to density, broadly conceived, pre-COVID

Results preview: Post-COVID

- The commercial rent gradient becomes smaller for transit cities, not car cities.
- The employment density premium becomes smaller for both transit cities and car cities.
- Transit station access premium falls.
- These are consistent with (a) a reduction in the value of city centers, but (b) value remains and (c) effects are heterogeneous

Related issues

- Housing affordability
- Productivity

Theory

- Rent is determined by bidding among potential tenants:
  - Gross profit depends on market interactions: $\pi(n)$
  - Market interactions depend on distance to CBD: n(d), $\partial n/\partial d < 0$.
  - Rent sets profit equal to zero: $r(n) = \pi(n)$

- COVID-19 impacts both the $\pi(n)$ and n(d) relationships, which will be reflected in r(n).

Data

- Data on over 68,000 leases from CompStak.
  - Street address, latitude/longitude
  - Lease type (e.g. new tenant versus renewal); Industry type (e.g. retail versus commercial)
  - Lease term, space leased, date lease executed
  - Effective rent (adjusted for upfront concessions like free months rent)

- Additional data were merged in from local planning authorities and Census. This provides information on …
  - 2018 employment density in the zipcode in which a lease is located
  - Distance to the closest rapid transit stop.

Data

- All leases were executed from January, 2019 through October 31, 2020

- Median lease length is 57 months → Commercial rent encompasses expectations of future value associated with a site, not just current conditions.

Organizing leases into cities

- In order to evaluate whether city centers are losing their appeal, we need to specify well-defined centers.

- But cities are multicentric, and for large urban areas, often ringed with important sub-centers.

- To address this, we organize our data into pseudo-monocentric cities using an iterative approach.

Organizing leases into core cities

- Step 1: Pool all leases across the country. Pick out the lease in the zipcode with the highest employment density.
- Step 2: Draw a circle of radius 25 miles around the target zipcode centroid. Assign all leases within that circle to the city in which the target zipcode is located.
- Step 3: Repeat steps 1 and 2 leaving out the previously assigned leases. Repeat this until all leases are assigned to a city.
- Step 4: Using the cities defined in Step 3 (89 cities in our data), reassign each lease to the closest city center.
- Step 5: We excluded leases in core cities with < 100 assigned leases

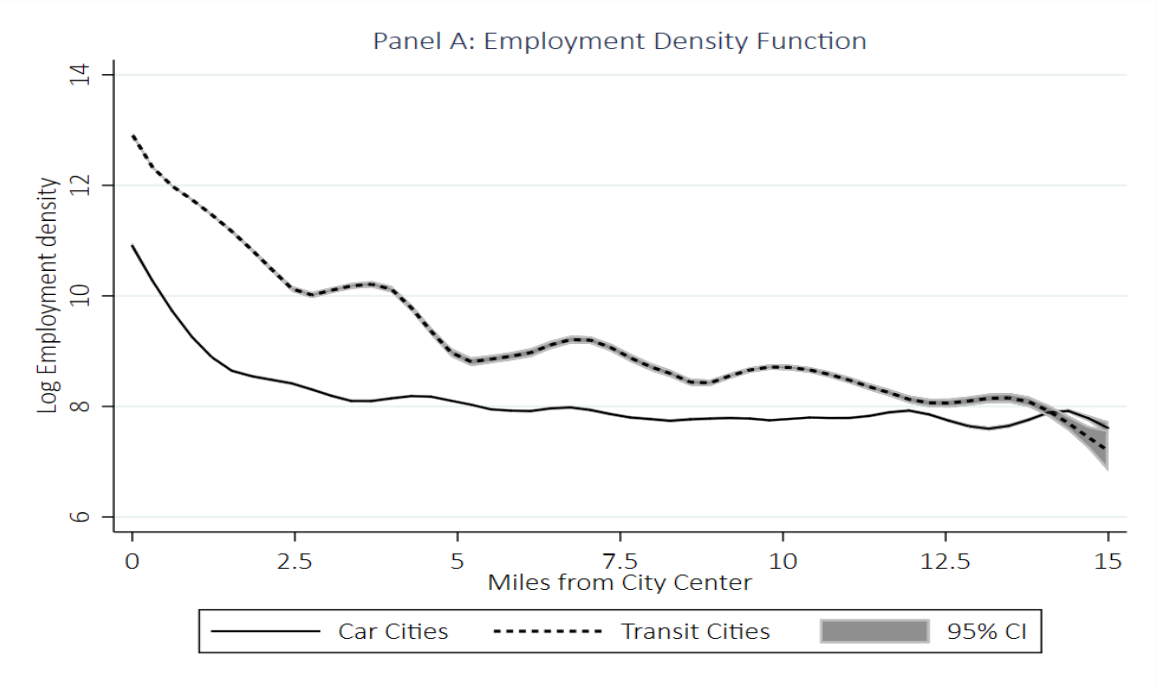
Car and transit cities

- Core cities are grouped into two groups. Those that rely heavily on rapid transit (in six MSAs) and all others
- We refer to the first group as transit cities and the second group as car cities
- Transit cities are in the following MSAs
  - NYC, Washington DC, Chicago, Boston, San Francisco, Philadelphia
- Transit cities are populous, dense, and expensive compared to car cities

Does employment density decline with distance?

- If our iterative approach to grouping leases into cities is successful, we should have created pseudo-monocentric cities.
- In monocentric cities, both rents and density depend on location.
- Is this the case?
- Are transit and car cities different in their density profiles?

Density declines with distance



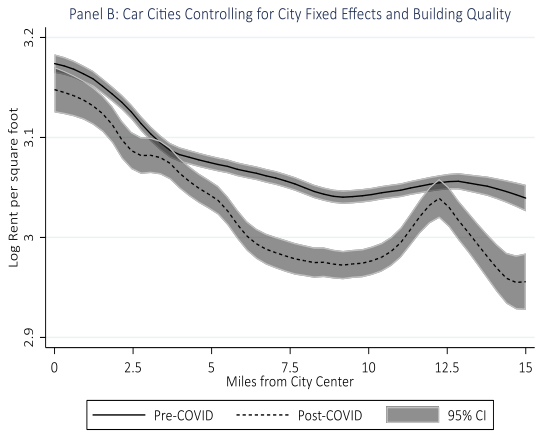
Panel A – Employment density gradient: Dep var = Log zipcode employment density[b]	**All Cities**	**Car Cities[c]**	**Transit Cities[c]**
Distance (miles) to CBD (D_{CBD})	-0.1989	-0.1372	-0.3783
	(-8.59)	(-10.14)	(-18.26)
Core city fixed effects[d]	89	83	6
Observations	63,886	48,590	15,296
R-squared	0.336	0.225	0.661

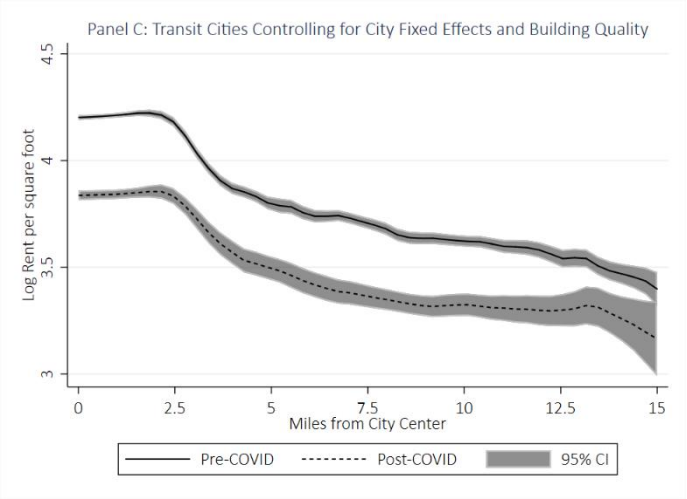
Density gradient is larger in transit cities

- The density gradient is larger in the transit cities: 38% versus 14%

- Theory suggests that the rent gradient should also be larger in transit cities

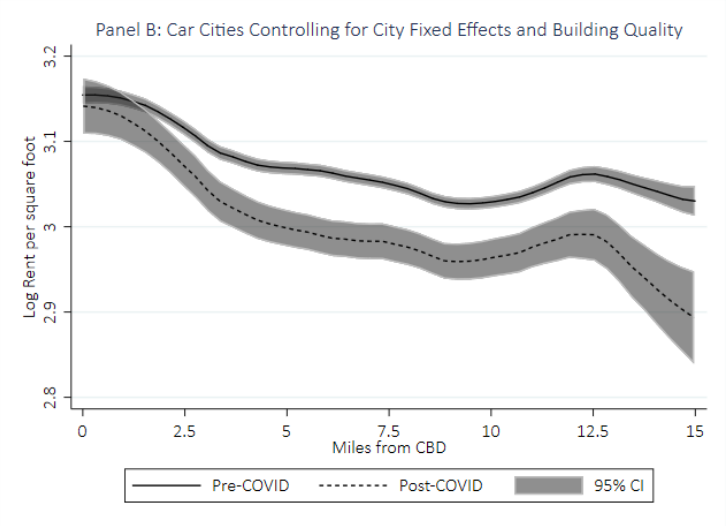
Rent declines more rapidly in transit cities

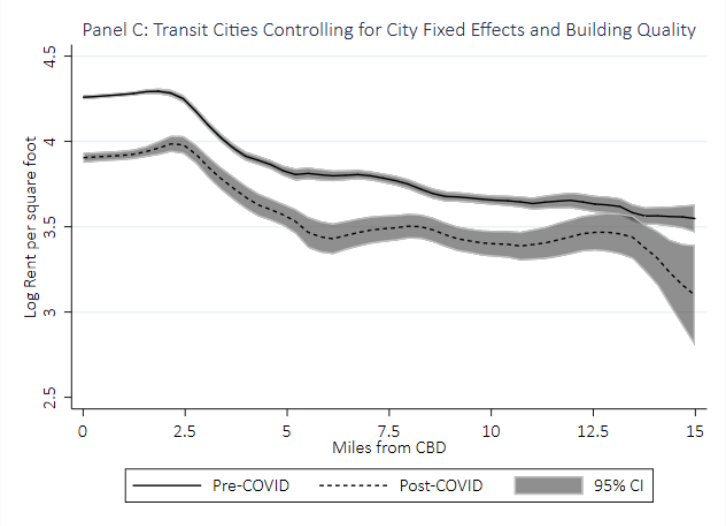




Panel B – Distance to CBD: Deb var = Log rent[b]	**All Cities**	**Car Cities[c]**	**Transit Cities[c]**
Post Covid (April 1 – Oct 31, 2020)[d]	-0.0395	0.0007	-0.0858
	(-1.47)	(0.04)	(-2.32)
Distance (miles) to CBD (D_{CBD})	-0.0227	-0.0092	-0.0633
	(-3.54)	(-2.46)	(-5.00)
D_{CBD} * Post Covid	0.0031	-0.0016	0.0094
	(0.96)	(-0.75)	(2.20)
Core city fixed effects[d]	89	83	6
Observations	68,638	52,490	16,148
R-squared	0.157	0.142	0.246

But COVID-19 reduces the gradient in transit cities





Panel B – Distance to CBD: Deb var = Log rent[b]	**All Cities**	**Car Cities[c]**	**Transit Cities[c]**
Post Covid (April 1 – Oct 31, 2020)[d]	-0.0057	0.0400	-0.0662
	(-0.19)	(2.19)	(-2.30)
Distance (miles) to CBD (D_{CBD})	-0.0212	-0.0088	-0.0631
	(-3.12)	(-2.19)	(-4.21)
D_{CBD} * Post Covid	0.0020	-0.0030	0.0116
	(0.53)	(-1.32)	(2.18)
Core city fixed effects[d]	109	102	7
Observations	53,092	40,838	12,254
R-squared	0.139	0.148	0.237

Rent also increases with local density but once again, more so in Transit cities pre-COVID

Panel C – Valuing employment density: Dep var = Log rent[b]	**All Cities**	**Car Cities[c]**	**Transit Cities[c]**
Post Covid (April 1 – Oct 31, 2020)[d]	0.1280	0.1021	0.1194
	(2.61)	(1.93)	(2.98)
Employment per square foot (D_{EmpDen})	0.0835	0.0455	0.1338
	(5.34)	(6.77)	(4.82)
D_{EmpDen} * Post Covid	-0.0177	-0.0143	-0.0169
	(-3.07)	(-2.45)	(-3.73)
Core city fixed effects[a]	89	83	6
Observations	68,638	52,490	16,148
R-squared	0.157	0.142	0.246

All cities see a weakening of the local density-rent relationship post-COVID

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So far…

- Flatter rent functions in transit cities post-COVID.
- Smaller local employment rent premium post-COVID.
- Overall, we see
  - The attraction of downtown is weakened but …
  - Not everywhere and…
  - Some attraction remains.

Extension for Transit Cities: Are the post-COVID patterns simply driven by retail? No!

	(1)	(2)	(3)	(4)
	Retail	Office	Retail	Office
Post Covid (April 1 – Oct 31, 2020)[d]	-0.2673	-0.0444	0.1154	0.0734
	(-3.19)	(-2.04)	(0.62)	(1.49)
Distance (miles) to CBD (D_{CBD})	-0.0942	-0.0571	-	-
	(-3.11)	(-8.20)	-	-
D_{CBD} * Post Covid	0.0260	0.0057	-	-
	(2.56)	(2.40)	-	-
Employment per square foot (D_{EmpDen})	-	-	0.2546	0.1164
	-	-	(4.39)	(7.60)
D_{EmpDen} * Post Covid	-	-	-0.0230	-0.0099
	-	-	(-1.22)	(-2.19)
Core city fixed effects	6	6	6	6
Observations	2,772	12,524	2,889	13,259
R-squared	0.246	0.361	0.310	0.326

Both retail and the office sectors are strongly affected by COVID-19

Extension for Transit Cities: New arrival lease versus lease renewal

	(5)	(6)	(7)	(8)
	New Lease	Renewal Lease	New Lease	Renewal Lease
Post Covid (April 1 – Oct 31, 2020)[d]	-0.0589	-0.1197	0.0674	0.1757
	(-1.48)	(-2.51)	(1.26)	(2.35)
Distance (miles) to CBD (D_{CBD})	-0.0655	-0.0617	-	-
	(-4.55)	(-5.38)	-	-
D_{CBD} * Post Covid	0.0057	0.0118	-	-
	(1.53)	(2.22)	-	-
Employment per square foot (D_{EmpDen})	-	-	0.1364	0.1319
	-	-	(4.44)	(5.27)
D_{EmpDen} * Post Covid	-	-	-0.0098	-0.0250
	-	-	(-2.17)	(-3.01)
Core city fixed effects	6	6	6	6
Observations	6,438	8,858	6,798	9,350
R-squared	0.269	0.256	0.256	0.242

Pre-COVID new and renewal estimates are very similar

Extensions for Transit Cities: New arrival lease versus lease renewal

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	New Lease	Renewal Lease	New Lease	Renewal Lease
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Distance (miles) to CBD (D_{CBD})	-0.0655	-0.0617	-	-
	(-4.55)	(-5.38)	-	-
D_{CBD} * Post Covid	0.0057	0.0118	-	-
	(1.53)	(2.22)	-	-
Employment per square foot (D_{EmpDen})	-	-	0.1364	0.1319
	-	-	(4.44)	(5.27)
D_{EmpDen} * Post Covid	-	-	-0.0098	-0.0250
	-	-	(-2.17)	(-3.01)
Core city fixed effects	6	6	6	6
Observations	6,438	8,858	6,798	9,350
R-squared	0.269	0.256	0.256	0.242

Post-COVID estimates: for renewals, rent discounts for "known, safer" tenants

Why are COVID-19 effects larger in transit cities?

- Some possibilities include …
  - Transit cities are big and dense, making them more vulnerable.
  - Transit cities were hit earlier and harder by COVID-19. Possibly this contributed to more cautious social behavior and stricter lockdowns.
  - Transit cities are culturally different, possibly implying different behavior and consequent differences in the spread of COVID-19
  - Transit cities also rely heavily on rapid transit which exposes riders to more risk than car travel.

COVID-19 and the built environment

- Has COVID-19 reduced the premium for locations close to a rapid transit station?

  → Estimate rent function with distance from transit stop pre- and post-COVID.

Partial linear regression

- Log rent depends linearly on location fixed effects β_j and X, and nonlinearly on z as $m(z)$

$$Log\ Rent = \beta_j + \beta_1 X + m(z) + \varepsilon$$

- We estimate $m(z)$ using the semipar routine in Stata which uses Robinson's (1988) double error approach.

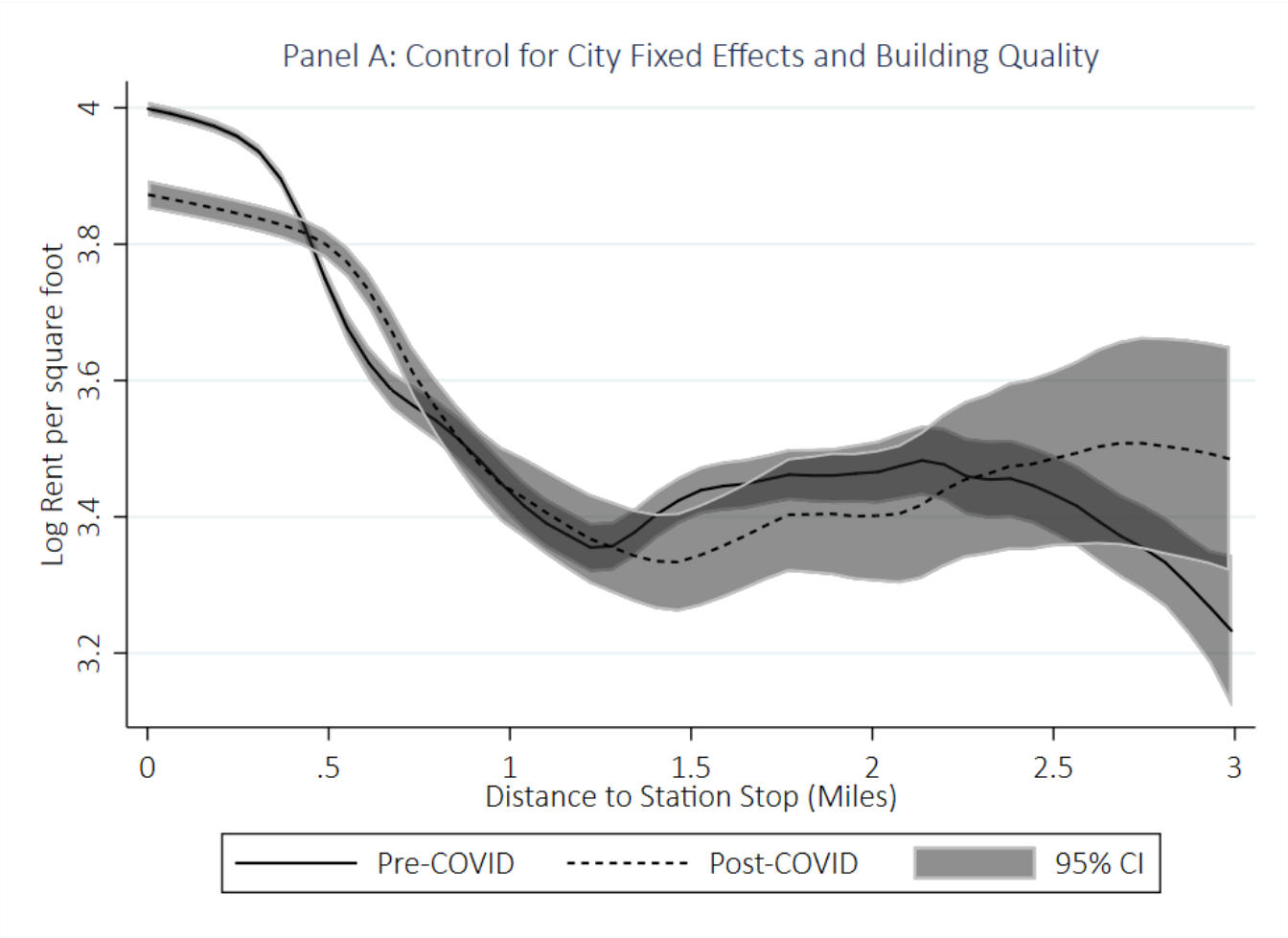
Partial linear regression

- Write the partially linear model as: $y = X\beta + m(z) + \varepsilon$
- Take expected values conditioning on z: $E(y|z) = E(X|z)\beta + m(z) + E(\varepsilon|z)$
- Differencing ➔ $y - E(y|z) = (X - E(X|z))\beta + \varepsilon$
- By estimating $E(y|z)$ and $E(X|z)$ nonparametrically and replacing them in the above equation, it is possible to estimate β consistently without modelling $m(z)$ since it differences out.

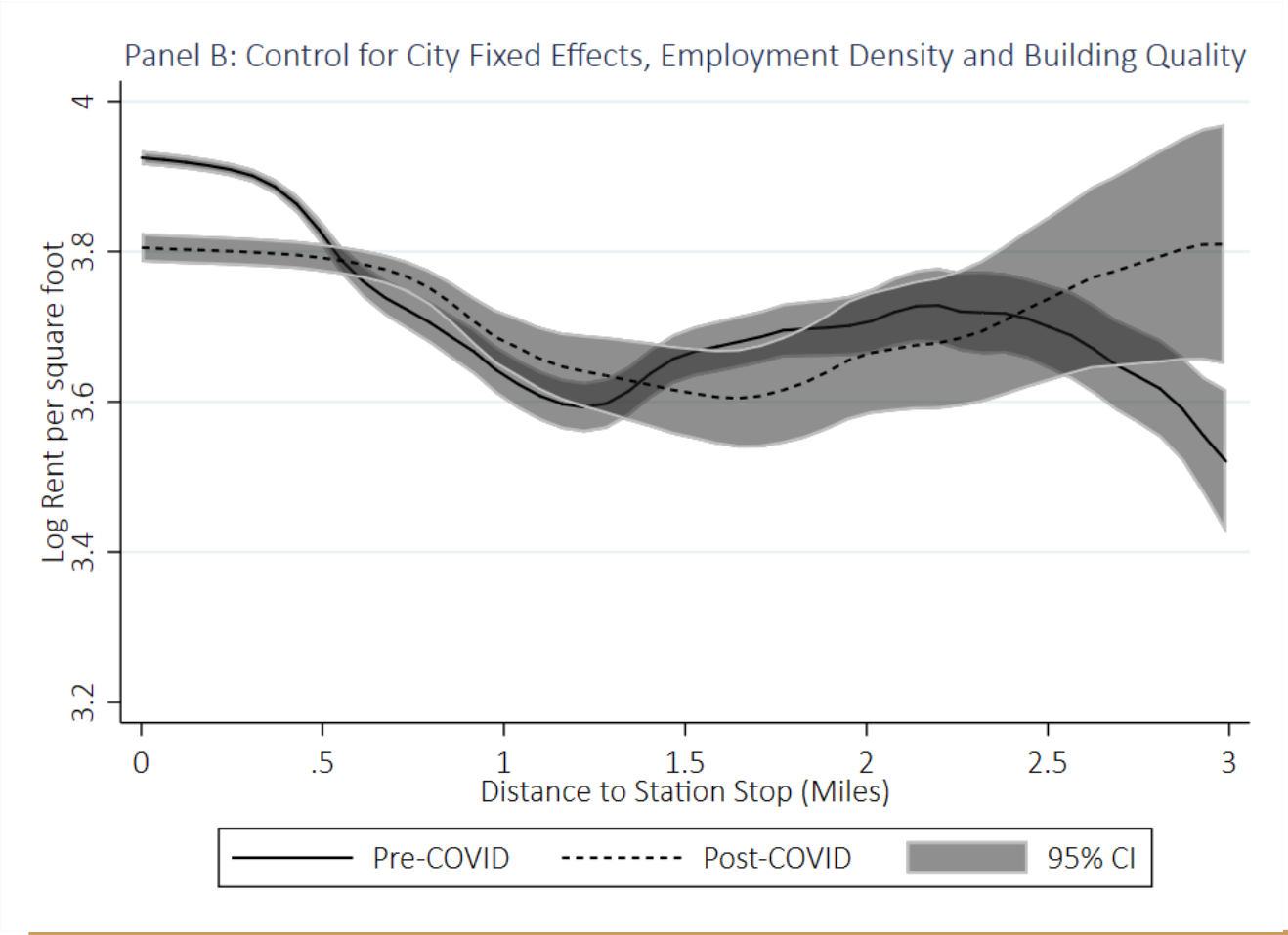
Partial linear regression

- Having estimated β, $m(z)$ can be estimated by regressing $(y - X\beta)$ on z nonparametrically.

Rent declines with distance to a transit station

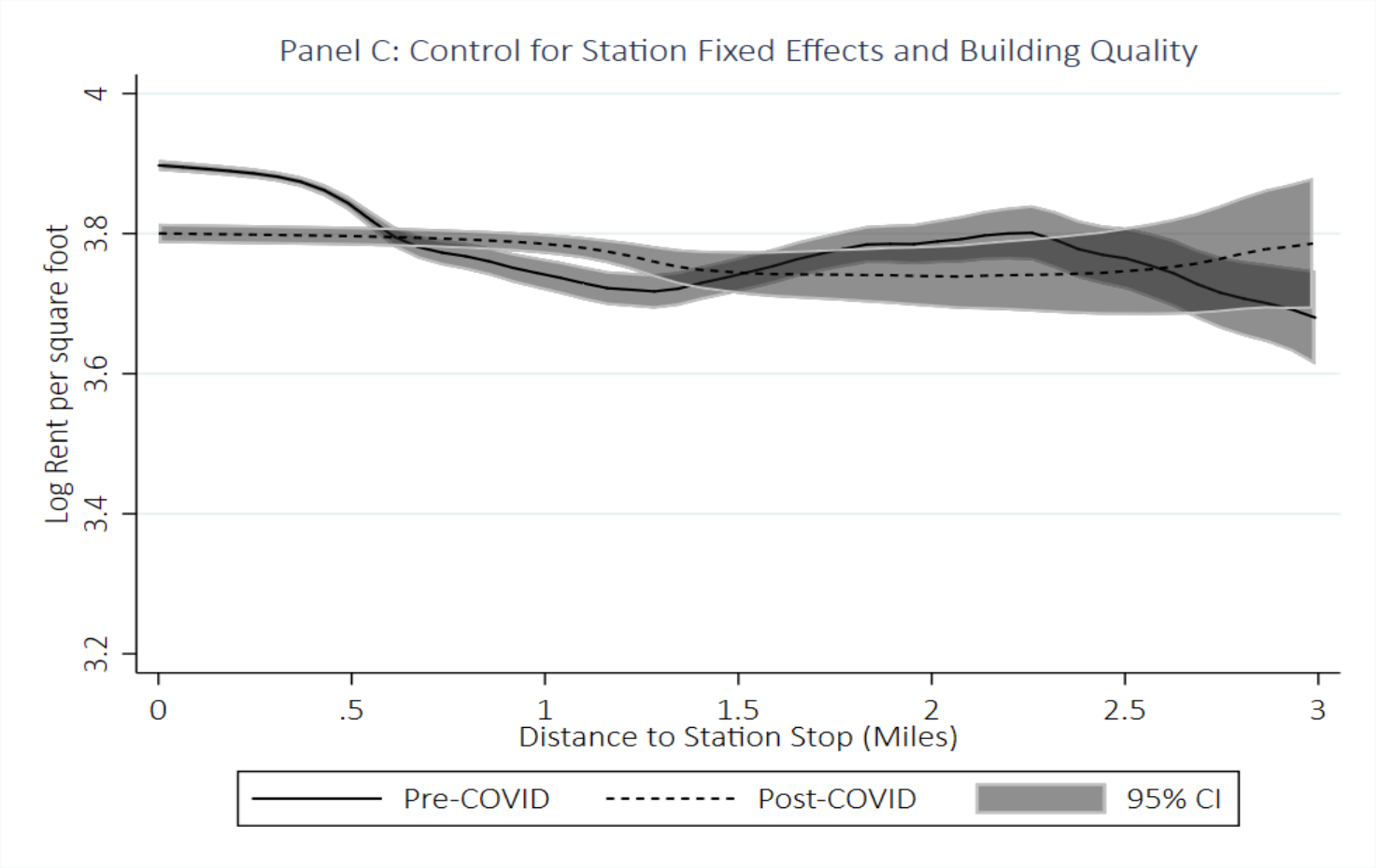


The rent-transit station relationship persists with local density controls



Controlling for local density mutes but does not eliminate the pattern

The rent-transit station relationship persists with local density controls



Controlling for local transit stop fixed effects further mutes the pattern

Conclusions

- Commercial rent data are increasingly available and provide a new way to evaluate the degree to which companies value different locations, including density.

- Pre-COVID, we obtain anticipated patterns
  - Rent declines with distance from the CBD
  - Rent is higher in high employment density locations
  - Rent declines with distance to a transit station that provides fast access to business centers

Conclusions

- COVID-19 has not affected all cities similarly.
  - Among transit cities, central locations and density are less valued, as is proximity to rapid transit.
  - Among car cities, we see only the local density effect.

- Will the effects on transit cities persist? While it is not possible to be certain, it is true that
  - Working from home has become established.
  - COVID-19 is unlikely to disappear.
  - The circumstances for the creation of novel viruses are present, and they do not seem to be weakening.