Unequal Growth in Local Wages: Rail versus Internet Infrastructure

Christiaan Hogendorn and David Schwartz*

December 30, 2017

Abstract

Several studies suggest that Internet infrastructure investments increase wage inequality and do little to increase wages in low-income areas ([Atasoy, 2013], [Forman et al., 2012]). One possible reason is that today any economic growth tends to raise inequality. On the other hand, maybe it is the Internet in particular. In this paper, we measure the local wage effects of investments in rail intermodal terminals. Like the Internet, these are general purpose facilities that provide transport inputs to a wide range of businesses. Unlike the Internet, rail intermodal focuses on the movement of physical goods rather than information goods. Our preliminary results suggest that rail intermodal does raise local wages and does not produce as much inequality as Internet infrastructure.
JEL No.: O18, J31

*corresponding author: Christiaan Hogendorn, Department of Economics, Wesleyan University, 238 Church Street, Middletown, CT 06459. Email: chogendorn@wesleyan.edu.

1 Introduction

In “The Internet and Local Wages: A Puzzle,” Forman, Goldfarb, and Greenstein (2012) (hereafter FGG) found that the business uptake of Internet technologies provides disappointing wage gains and the benefits are largely limited to technology hubs. This leads to a natural question: is this finding the result of the growing inequality of the economy or is it specific to Internet infrastructure. We suggest that intermodal railroad terminals, where containers can be transferred to and from trains for access to local businesses, are a similarly open technology that might affect local wages. It is reasonable to hypothesize that intermodal rail can be complementary to different types of assets, places, and labor.

Considerable attention has been recently focused on the impact of broadband Internet, introduced in 1995, as a modern economic growth engine. Forman et al. (2012) found a positive association between broadband investment and wage growth between 1995 and 2000. However, wage growth was primarily observed in only a small group of counties that were high on a combination of factors: population, Internet density, income, and education. Perhaps less noticed, the adoption of the standardized “box” in 1972 coupled with deregulation and investment, created an opportunity for intermodal rail to contribute to interstate and international commerce and to accelerate modern economic growth. Thus, extending the work by Forman et al. (2012) to directly evaluate the change in intermodal rail availability between 1995 and 2000 on change in wage growth during the same time period is a an interesting comparison study.

We believe this the first study to examine the relationship between intermodal rail investment and wage growth, and it also uses a novel GIS approach to quantify intermodal rail investment, overcoming the absence of publicly available information on intermodal rail investment. By focusing on the same time period as FGG and using their publicly accessible dataset, this study enables a comparison of the impact of Internet availability and intermodal rail on wage growth.

2 Intermodal Availability

As in FGG, we look at wage growth count-by-county. We create an index of intermodal rail availability in each county in 1995 and 2000. We start with a list of approximately 170 rail intermodal terminals listed in the *Official Railway Guide*.

No data is publicly available describing the size or capabilities of these terminals. To address this we used publically accessible historical satellite imagery to analyze each of the intermodal facilities. The layout of these terminals is very similar across the United States and typically includes an intermodal rail yard with one or more tracks surrounded by concrete platforms for container loading equipment.

We used Google Earth Pro to measure the number and total length of intermodal tracks for each intermodal rail facility. We argue these measures are a good proxy for actual availability because a higher number of track feet will increase the speed at which a terminal can load and unload containers, thus any change seen from satellite imagery is a good indication of investment to improve access.

Containers need to be moved (typically via truck) from the origin point to an intermodal terminal. The distance between the origin and the intermodal terminal is known as the "drayage distance," and it determines the market area that is relevant to an intermodal terminal. After a review of the literature, the best estimate we found for average drayage distance is [Craig et al., 2012], who give a figure of 146 miles based on a J.B. Hunt dataset of actual distances. We understand this to be the drayage distance at both ends of a trip, so this implies a terminal market area extending to 73 miles on average, but presumably more miles for above-average dryge distances. If indeed the mean of 73 miles is centered on a symmetric distribution, then a maximum drayage distance of 146 miles may be justified.

Thus we used an index of intermodal availability for each county based on the number of track feet of each terminal within a 146-mile radius, adjusted for the distance from the center of the county. For each of the 3143 counties in the U.S., we found every intermodal terminal within 146 miles of the county center. For each terminal i we found the total track feet f_i, and then scaled linearly relative to the posited 146 mile maximum drayage distance. The "decaying track feet" of terminal i with d_i miles from the county center is $\frac{146-d_i}{146} f_i$, and the index of intermodal availability for a county with n intermodal terminals within 146 miles is

$$index = \sum_{i=1}^{n} \frac{146 - d_i}{146} f_i$$

For ease of interpretation, we then normalize these indices with respect to the county with the highest index, which not surprisingly is Cook County, Illinois. Then the highest index counties and the counties with the largest changes in index from 1995 to 2000 are shown in the following tables.

Table: Counties with Highest Intermodal Availability Index

	County	index1995	index2000	change9500
1	Cook County, Illinois	1.00	1.00	0.00
2	DuPage County, Illinois	0.93	0.93	0.00
3	Grundy County, Illinois	0.70	0.70	0.00
4	Kane County, Illinois	0.80	0.80	0.00
5	Kankakee County, Illinois	0.72	0.72	0.00
6	Kendall County, Illinois	0.78	0.78	0.00
7	Lake County, Illinois	0.78	0.79	0.00
8	Will County, Illinois	0.85	0.86	0.00
9	Lake County, Indiana	0.84	0.84	0.00
10	Porter County, Indiana	0.77	0.77	0.00

Table: Counties with Highest Change in Intermodal Availability Index

	County	index1995	index2000	change9500
1	Alameda County, California	0.07	0.14	0.08
2	Contra Costa County, California	0.07	0.14	0.08
3	Marin County, California	0.06	0.12	0.06
4	San Joaquin County, California	0.06	0.13	0.07
5	San Mateo County, California	0.06	0.12	0.07
6	Santa Clara County, California	0.06	0.12	0.06
7	Santa Cruz County, California	0.05	0.10	0.06
8	Solano County, California	0.06	0.13	0.07
9	Stanislaus County, California	0.06	0.12	0.06
10	Lorain County, Ohio	0.06	0.11	0.05

The fact that the largest changes by this measure are in the Bay Area of California will cause us some difficulties in interpreting the results below.

3 Econometric Model

FGG argue that their analysis can be interpreted as "differences in differences" because the Internet was not used by any businesses before 1995. Thus they assert that the 1995 level of Internet activity was essentially zero and therefore the 2000 level of Internet can be interpreted as a change. We could not say the same for intermodal rail, so we took the change from 1995 to 2000 to preserve the differences in differences approach. The change can be interpreted as the number of percentage points that the county rose or fell on the continuum of intermodal availability.

We checked that we can replicate the FGG results, but then we reran their regressions excluding Alaska and Hawaii since these states are not connected to the national railroad network. Summary statistics for all counties in the contiguous 48 states are reported in the following table.

Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
pctblk1990	3,104	0.087	0.144	0.000	0.862
pct65p1990	3,104	0.149	0.043	0.014	0.341
pctunivp1990	3,104	0.135	0.066	0.037	0.537
pctHSp1990	3,104	0.697	0.104	0.317	0.962
medhhinc1990	3,104	23.857	6.461	8.595	59.284
pctbelowPL1990	3,104	0.167	0.079	0.022	0.631
broadband00	2,720	0.089	0.134	0.000	1.000
frprof	3,104	0.352	0.066	0.160	0.674
frac_in_eng_prog	3,104	0.001	0.006	0.000	0.112
carnegie1_enr	3,104	0.007	0.065	0.000	2.615
npatent1980s	3,104	0.138	0.655	0.000	20.417
netmig95	3,104	0.258	3.640	−138.933	72.891
wagediff	3,104	0.188	0.089	−1.752	1.117
change_totalpop	3,104	0.097	0.133	−0.325	1.068
change_pctblk	3,104	0.001	0.018	−0.099	0.272
change_pctunivp	3,104	−0.026	0.021	−0.146	0.075
change_pctHSp	3,104	−0.187	0.052	−0.324	−0.029
change_pct65	3,104	−0.001	0.014	−0.092	0.085
change_netmig	3,104	−0.148	3.301	−54.679	141.387
lnpop	3,104	10.143	1.360	5.869	15.997
index1995	3,104	0.038	0.082	0.000	0.998
index2000	3,104	0.039	0.083	0.000	1.000
change_intermodal9500	3,104	0.002	0.007	−0.003	0.075

The variable on business broadband use in 2000 is only available for some counties, thus regressions including this variable will cover fewer counties than those without.

FGG run regressions of the logged wage difference between 1995 and 2000 on all of the above variables other than the last 3. We report these results in column 1 below and find a slightly smaller and less significant coefficient on the broadband variable than in FGG due to the exclusion of Alaska and Hawaii.

We then added the change in the index of intermodal availability to the FGG model (column 2) and also added intermodal availability but deleted FGG's internet variables (column 3).

	Dependent variable: wagediff		
	(1)	(2)	(3)
internet00	0.027**	0.027**	
	(0.013)	(0.013)	
change_intermodal9500		0.470*	0.386
		(0.260)	(0.264)
lnpop	−0.007***	−0.007***	−0.005**
	(0.002)	(0.002)	(0.002)
pctblk1990	0.010	0.011	0.018
	(0.012)	(0.012)	(0.013)
pctunivp1990	0.550***	0.555***	0.401***
	(0.084)	(0.084)	(0.096)
pctHSp1990	−0.142***	−0.146***	−0.031
	(0.053)	(0.054)	(0.067)
pctbelowPL1990	−0.115**	−0.125***	−0.012
	(0.048)	(0.048)	(0.051)
medhhinc1990	0.0004	0.0002	0.001
	(0.001)	(0.001)	(0.001)
carnegie1_enr	0.030	0.030	0.031
	(0.109)	(0.108)	(0.102)
frac_in_eng_prog	−0.180	−0.189	−0.104
	(0.558)	(0.556)	(0.516)
npatent1980s	0.016***	0.016***	0.015***
	(0.005)	(0.005)	(0.005)
frprof	−0.007	0.003	0.044
	(0.055)	(0.056)	(0.070)
pct65p1990	0.058	0.052	0.129**
	(0.054)	(0.054)	(0.064)
netmig95	0.003	0.003	0.002
	(0.005)	(0.005)	(0.005)
change_totalpop	0.050***	0.052***	0.072***
	(0.017)	(0.017)	(0.017)
change_pctblk	0.018	0.029	−0.055
	(0.077)	(0.076)	(0.080)
change_pctunivp	0.781***	0.778***	0.586***
	(0.160)	(0.159)	(0.184)
change_pctHSp	−0.005	−0.002	0.120
	(0.096)	(0.095)	(0.122)
change_pct65	−0.557***	−0.559***	−0.492***
	(0.123)	(0.123)	(0.134)
change_netmig	0.002	0.002	0.001
	(0.007)	(0.007)	(0.007)
Constant	0.296***	0.307***	0.171***
	(0.041)	(0.042)	(0.049)
Observations	2,720	2,720	3,104
R^2	0.130	0.131	0.099
Adjusted R^2	0.124	0.125	0.094
Residual Std. Error	0.075 (df = 2700)	0.075 (df = 2699)	0.085 (df = 3084)
F Statistic	21.168*** (df = 19; 2700)	20.386*** (df = 20; 2699)	17.870*** (df = 19; 3084)
Note:			*p<0.1; **p<0.05; ***p<0.01

We do find a positive association between intermodal availability and county wage growth, but it is only marginally statistically significant. However, it is also considerably affected by changes in how we calculate the intermodal availability index, and by the inclusion the Bay Area counties that account for a large increase in wage growth and in intermodal terminal trackage. (Removing California entirely causes the intermodal change variable to have no effect.)

In addition to ironing out these concerns, there are several other further questions to work out. First, we are not convinced that intermodal terminals located at or near seaports have similar effects to those located inland. Second, we want to use manufacturing wages as an alternative measure to total wages. Third, although we believe endogeneity is not a problem here, we do have some ideas for instrumental variables for intermodal terminal construction, namely the location of past rail junctions and the amount of acreage owned by railroads in the pre-intermodal era.

References

[Atasoy, 2013] Atasoy, H. (2013). The effects of broadband internet expansion on labor market outcomes. *ILR Review*, 66(2):315–345.

[Craig et al., 2012] Craig, A. J., Blanco, E. E., and Sheffi, Y. (2012). Estimating the co2 intensity of intermodal freight transportation. *ESD Working Paper Series*.

[Forman et al., 2012] Forman, C., Goldfarb, A., and Greenstein, S. (2012). The internet and local wages: A puzzle. *American Economic Review*, 101(1):556–575.