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*California High-Speed Rail and Economic Development: Lessons From Japan*

# California High-Speed Rail and Economic Development: Lessons From Japan

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California High Speed Rail (CHSRL) is once again in the news as the governor and state legislature take up the issuance of construction bonds approved by the voter passage of Proposition 1A of 2008. Under “project vision and scope” on the CHSRL Authority website are listed three categories of benefits: economic, environmental and community. In this article we focus on the economic benefits.

Specifically we look at economic growth and, by implication, job creation. That is to say, we are examining the benefit side of the equation and leaving the cost side to other analysis. Though CHSR Authority has developed and vetted a forecasting model and has commissioned a number of economic impact studies, these rely on relatively strong, though perhaps plausible, assumptions. As an alternative, we examine an actual case of high speed rail, one that has been widely deemed a success,<sup>1</sup> for evidence of the magnitude of benefits measured by induced GDP growth that one can expect from the building and operation of CHSR over the next 40 years.

Our study of the Japanese Shinkansen system from 1964 to present fails to provide evidence of induced aggregate growth. Rather, the evidence suggests high-speed rail simply moves jobs around the geography without creating significant new employment or economic activity. That is not to say that CHSR is not justified by population growth, pollution abatement, or other factors. However, the evidence from Japan is relatively clear. As an engine of economic growth in and of itself, CHSR will have only a marginal impact at best.

Governor Brown claims CHSR to be a visionary project along the lines of the U.S. Interstate Highway System, The California Central Water Project, and the Panama and Suez Canals. As with these projects, Governor Brown claims HSR will result in job creation, economic development, particularly in the Central Valley, the accommodation of population growth and a cleaner environment.<sup>2</sup>

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The California High Speed Rail Authority (CHSRA) has a set of studies demonstrating a sufficient benefit cost analysis, a business plan that claims operating costs will be covered by setting prices at the currently charged airline prices for travel between Los Angeles and the Bay Area.<sup>3</sup> The principal economic benefits cited by the CHSR Authority are the creation of 100,000 construction jobs for the duration of the project, operation and maintenance jobs for the running of the trains, and the creation of 450,000 jobs and faster economic growth as a benefit of the existence of the rail lines.<sup>4</sup>

But, critics of the business plan abound. The Board of Supervisors from both Tulare and Kern Counties, counties who would presumably benefit from the increased connectivity and economic growth potential of CHSR voted their opposition to the program as “currently constituted.”<sup>5</sup> Moreover, questions have been raised about construction costs and timing, environmental impact, operating costs and ridership forecasts.<sup>6</sup> The State Legislative Analyst’s Office, while not taking a position on the desirability of CHSR, has critiqued the decision making process and the quality of information available for legislators to properly evaluate the issue.<sup>7</sup>

### **The Shinkansen**

HSR systems have been around since the opening of the Japanese Shinkansen (literally “new trunk line”) in 1964. In addition to Japan, China, Taiwan, France, Italy, Spain and Germany all have HSR systems. A number of studies of the ex post economic impact of the high speed rail infrastructure have been completed and the results are often cited in reference to the CHSR project. Unfortunately, many of the studies suffer from not being able to observe what would have happened if the HSR project had not been undertaken, or if some other mode of transportation would have been further developed.<sup>8</sup>

The Shinkansen provides an exception to this. Construction began in 1959 as part of the re-building of Japanese infrastructure after the Second World War. At that time commercial air transport was not a viable alternative to rail and road transport and the state of Japanese roads combined with the country’s geography and relatively dense populations made rail a potential good choice.

Since the opening of the first line between Tokyo and Osaka (the Tokaido Line) Japan has opened at least one new line on average every 4 ½ years. The current system stretches throughout Japan and new lines have entered during all portions of the business cycle, before and after air transport was competitive, and before and after a good system of trunk highways had been built.<sup>9</sup>

Thus, there is considerable variation in the conditions under which the Shinkansen appeared, variation which can help sort out the economic growth which would have occurred anyway, and that which is derivative from the existence of HSR. In this essay we report on our research on the macro-economic impact of the introduction and operation of the Shinkansen as a way of gaining insight as to what to expect from CHSR and how to view the economic impact results of the CHSR Authority.

As a comparative case study, Japan is a good model for California. It is a mountainous country with the population spread linearly from north to south. Japan is a mixture of very large cities, mid size cities and small cities in rural regions. As with CHSR, the Shinkansen passes through Prefectures (the Japanese equivalent of states, or in the case of California counties) with each of these characteristics. Alternative modes of transport, air, sea, and highway, are available and are well developed. Japan does differ from California in that the urban centers are much more densely populated, a difference that

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would impact revenue estimates but which is not as relevant to our analysis. In this paper we focus on the first Shinkansen Line, as it is representative of our analysis of the entire system.

**The Tokaido Line**

The Tokaido line was opened in 1964 connecting the population centers of Tokyo and Osaka. The route passed through 8 prefectures of which Shiga, Gifu, and Shizuoka were rural based economies and the urban centers of Tokyo, Yokohama, Nagoya, Kyoto and Osaka dominated economic activity in the remaining. The Tokaido Shinkansen was part of the rebuilding of Japanese infrastructure after World War II. At the time, Japan's rail system was slow and inefficient. Air travel was in its infancy and was not considered a competitive alternative. While the building of freeways was an option, the proponents of the Shinkansen won out. During the 60s Japan's economy was growing rapidly and the population was moving to the urban centers. Moreover, the Japanese population was accustomed to traveling on trains and the transition to high speed rail was one of speed not mode.

Thus, the Tokaido Shinkansen, widely considered a success based upon ridership (over 400,000 riders per day), ought to provide a clear indication of the impact of high-speed rail infrastructure on economic growth. The growth and development of some of the cities along the Tokaido Line such as Kakegawa in Shizuoka Prefecture are cited as evidence of the spill over or "external" impact of the introduction of the Shinkansen in Japan.<sup>10</sup>

The argument is made that, as a result of the rail line, cities such as Kakegawa, mid-way between Osaka and Tokyo, enjoy increased tourism, business conferences, light industry and importantly long dis-

tance commuters.<sup>11</sup> Kakegawa and other cities on the Tokaido Line thus share geographical similarities and potential economic benefits with the California cities Fresno, Visalia, and Bakersfield.

One reason for a lack of detailed study of the economic impact of the Tokaido Line on prefecture and aggregate economic growth is a lack of GDP data by prefectures. The aggregate or macro approach is in our view a more appropriate way to understand the overall economic impact because even if Kakegawa and other cities like it prospered after 1964, if they did so at the expense of other cities then there might be a local case for the Shinkansen, but not a national case. We solve the lack of data problem by estimating GDP levels from available prefecture tax data. For the years when both are available, we find the correlation between prefecture GDP and prefecture tax revenues to be greater than 95% in both growth and recession periods. We are then able to estimate the missing prefecture GDP data from tax data.<sup>12</sup>

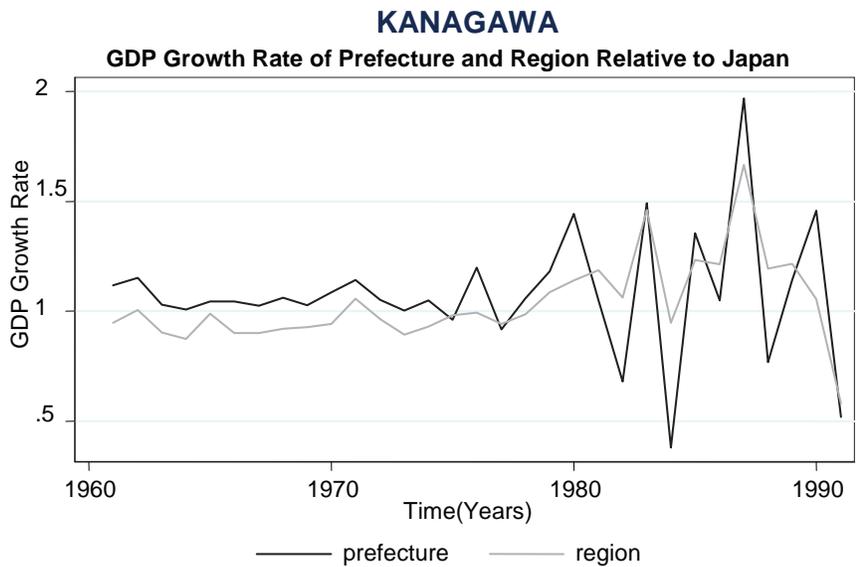
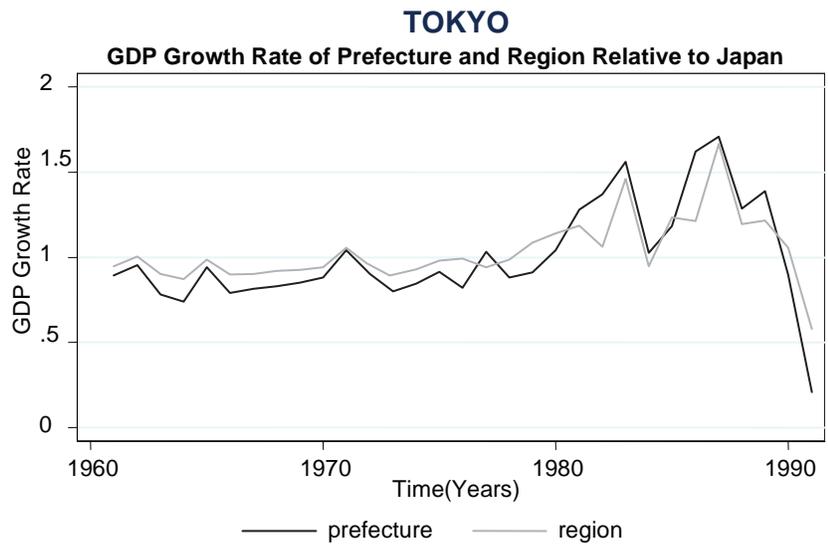
The prefecture of Kanagawa is the most cited for its economic revival as a transit hub for the Tokaido Line. Kanagawa Prefecture lies directly to the south of Tokyo and contains the city of Yokohama. As an outlying city close to the capital, one would expect the lower transportation costs to pull the two markets closer together and to create spatial efficiency and economic growth. The other prefectures surrounding Tokyo -- Chiba, Saitama, and Yamanashi -- had slower speed passenger and freight rail as well as a rebuilt road systems but did not benefit from being part of the original Shinkansen.

The first set of charts displays real income growth in the prefectures in the Tokyo region relative to regional growth rates. On each chart the performance of the region relative to Japan is shown as a reference line, a line that allows us to compare each

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prefectures performance with other prefectures. Not only does there not appear to be a pattern of increased growth after 1964 in Tokyo and Kanagawa prefectures, the two on the Tokaido Line, but they move

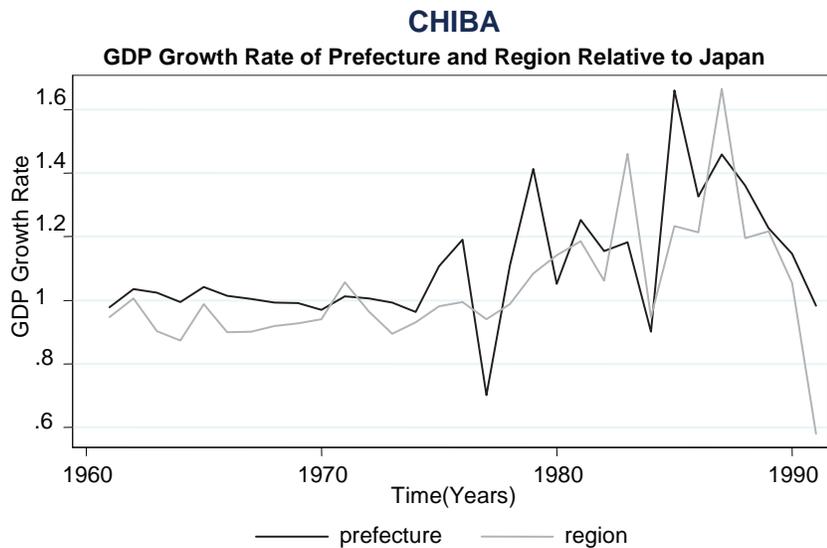
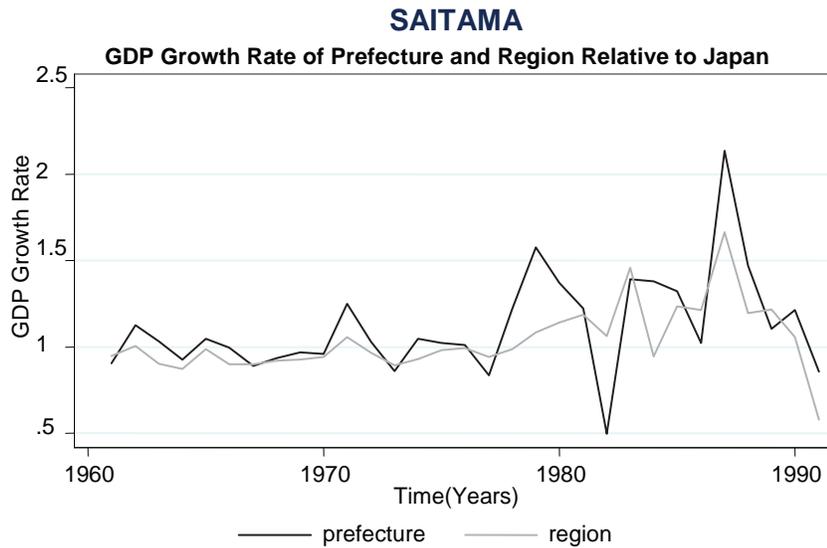
in opposite directions. Moreover, Chiba prefecture growth is every bit as robust as Kanagawa without a Shinkansen.

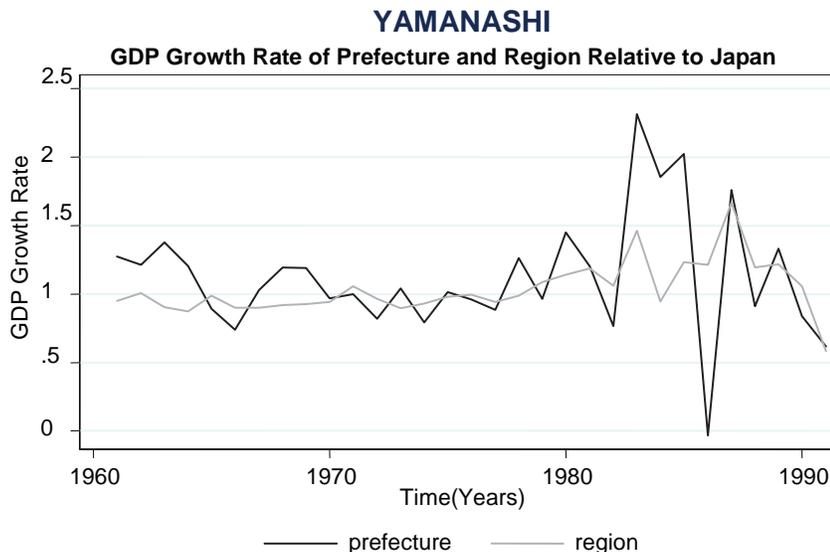


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What is striking about these charts is not only is there no systematic difference between the regional growth rates and the Shinkansen prefecture growth rates, but the economic data does not even give a clue

as to where the Shinkansen was nor when it went into service. To be sure, JR Central, the operator of the Tokaido Line, has hired conductors, maintenance, operations, and managerial personnel to run the line. But



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to the extent that these are additive jobs, their impact is too small to show up as a change in either growth rates or the levels of economic activity. By comparison, the estimated economic development jobs from CHSR would be equal to a quarter of all current employment from Sacramento to Kern County and a very large percentage of all employment along the proposed route.

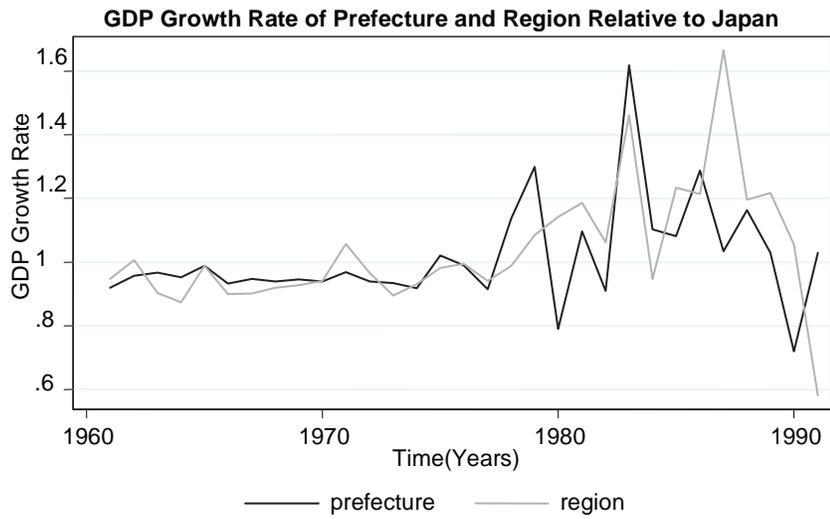
The next set of prefectures we consider are more rural, and more like the Central Valley counties in California. Along the Tokaido Line are the prefectures of Shizuoka, Aichi, and Gifu and nearby the non-Shinkansen prefectures of Mie, Nagano and Nara.

As with the prefectures near Tokyo, GDP growth for these prefectures differs from the regional growth for reasons that are uncorrelated with the existence of high speed rail infrastructure. Additionally, there is no spike in GDP growth in 1964, nor is there a change in the pattern between pre-Shinkansen and post-Shinkansen economic growth.

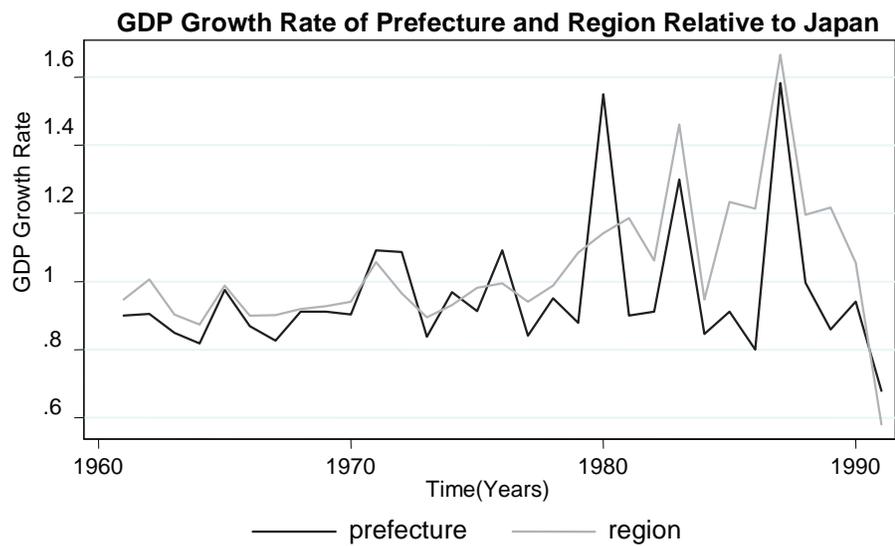
For brevity we have limited our examples to this one measure of prefecture GDP and to these prefectures. Our research has incorporated other measures and all of the prefectures in Japan. In no case did we find results different from Tokyo and its environs or the more rural prefectures between large urban populations.

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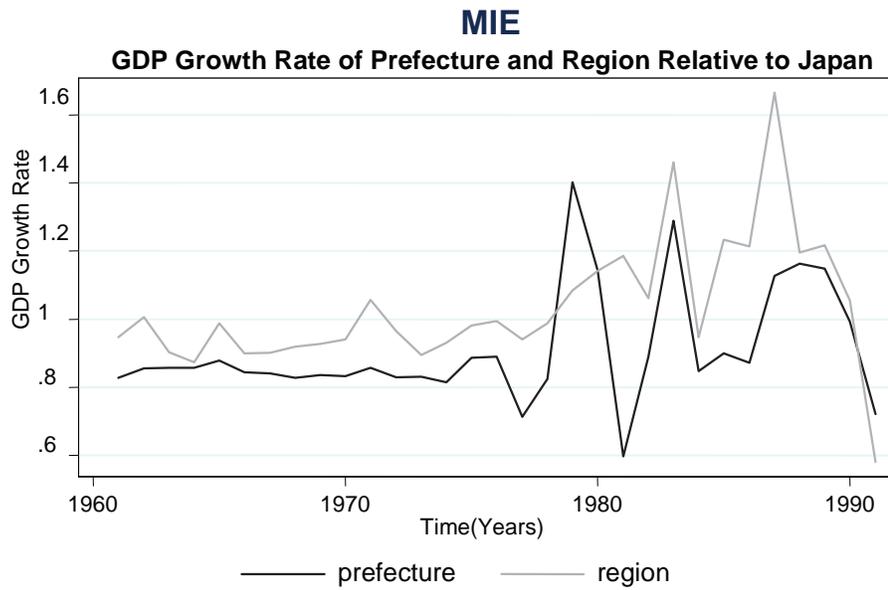
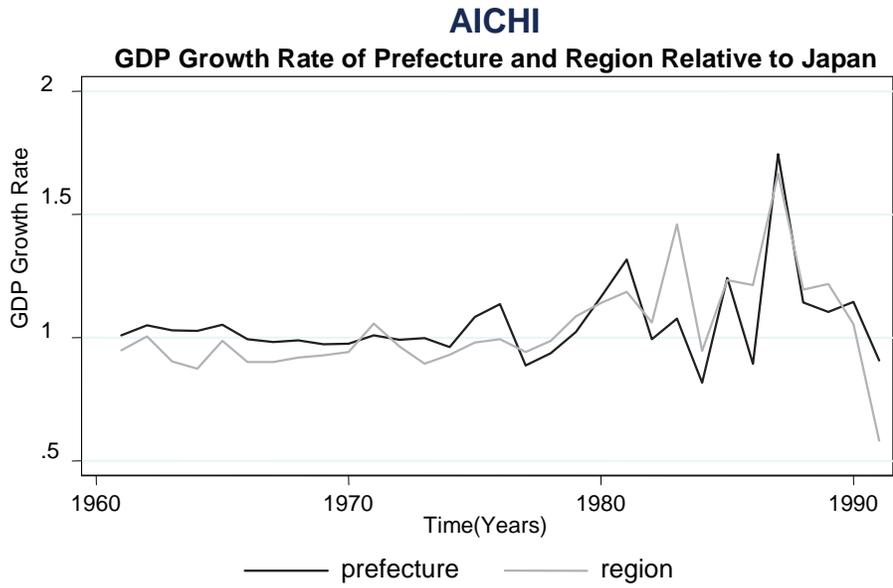
**SHIZUOKA**



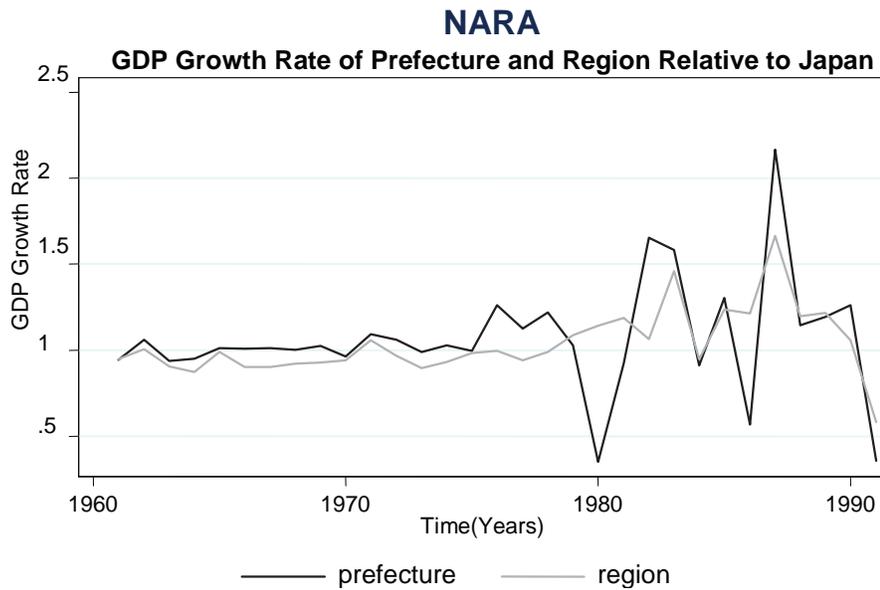
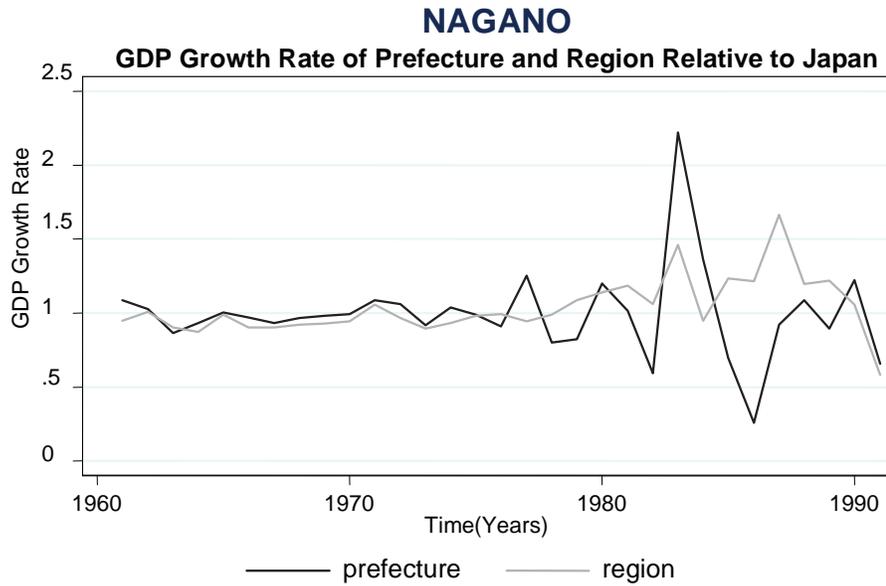
**GIFU**



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*California High-Speed Rail and Economic Development: Lessons From Japan***Interpretation of the results**

Most studies of transportation infrastructure demonstrate economic growth effects. Appropriate infrastructure lowers transportation costs particularly with respect to goods, creates larger markets, and provides opportunities for the more efficient allocation of labor and land. History tells us that lower costs leads to more output and hence, more rapid economic growth, at least in the near-term following the completion of the infrastructure.

So how can it be that we don't find such increases either in the examples presented here or in our more complete study of all of the prefectures in Japan? The answer is quite straightforward. High-speed rail serves passengers not freight. Lower transportation costs benefit passengers, but tends to have only a marginal impact on markets. While it is true, for example, that CHSR makes Los Angeles shopping less costly for Kern County residents and San Francisco shopping less costly for Stanislaus County residents, in the aggregate this effect is likely small. Similarly, sellers of personal services such as legal, accounting, and design services, might find a larger market due to high-speed rail, but the growth potential is also probably quite small.

The evidence on ex-post benefits to the Shinkansen as well as to high-speed rail in Europe tends to be more closely aligned with the impact on commuters. With transportation costs lower, individuals have a wider choice of where to live relative to their work. The evidence from France and Spain suggest a sorting of domicile subsequent to the introduction of high-speed rail. We see exactly the same phenomenon in Japan.

The Shinkansen lowered transportation costs for commuting into Tokyo, Osaka, Nagoya, and Kyoto. As a consequence, those who would have preferred to live in the more rural areas but did not because of the high cost of commuting to work, suddenly found

this to be an attractive option. By moving out of the city they generated economic growth in the newly minted bedroom communities. This would be where their children would go to school, where they would shop and dine, and where they would demand public services.

However good that might have been for places like Kanagawa, it was done at the expense of the urban centers. By moving that shopping, dining, and attendance at school out of Tokyo, the center city lost demand and lost economic activity and therefore on net, it is hard to identify any aggregate gain from the Tokaido Line. Would Kanagawa have grown as fast as, say Chiba, were it not for the Shinkansen? It is hard to say. But given that Tokyo underperformed the region subsequent to the introduction of the Shinkansen, we find that we certainly cannot make the case that either the Tokaido Line, nor the other Shinkansen we studied had discernable economic impacts other than increasing suburbanization and decreasing density in major city centers.

**Conclusions**

In this study we have looked for, and failed to find evidence of economic development that could be clearly identified with the introduction or operation of high-speed rail in Japan. This is surprising because, at least for the Tokaido Line, conditions were ripe for economic development. To be sure the prefectures along the Tokaido Line grew. The late 60s and early 70s were a period of transformation and growth throughout Japan. But the data don't admit a clear story that high-speed rail was in and of itself a differentiating contributor.

Is it possible that absent high-speed rail Kanagawa Prefecture would have grown more slowly? That is an experiment that can never be performed. But when we keep in mind that Japan's growth in the 60s and 70s were due to exports of goods and Kanagawa's main city, Yokohama, is a major port city for the

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Tokyo area, it is easy to conclude that the economic growth would have occurred with existing low speed rail and truck transport.

The lessons for California are two-fold. First, high-speed rail tends to create sprawl as it lowers the cost for commuters and makes more far-flung locations possible bedroom communities. This may be considered a benefit by some and a detriment by

others. Second, the claims that a multiplier effect (or economic development effect) of 450,000 jobs as a result of the introduction and operation of CHSR are not likely to be realized. There may be good reasons to invest in CHSR including the possibility that CHSR is the optimal infrastructure investment for a growing population; but the economic argument, the jobs argument, does not seem to stand on very solid ground.

### Endnotes

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Jerry Brown, "Governor Brown Issues Statement On High Speed Rail Business Plan," October 1, 2011, <http://gov.ca.gov/news.php?id=17298>
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6. Adam Nagourney, "California Bullet Train Advances Amid Cries of Boondoggle," *New York Times*, November 26, 2011.
7. LAO, "2012-2013 Budget: Funding Requests For High Speed Rail," April 17, 2012, <http://www.lao.ca.gov/analysis/2012/transportation/high-speed-rail-041712.aspx>
8. The studies are mixed in their identification of positive economic growth effects. Those that purport to show unambiguous results often grapple with the confounding of other forces generating economic growth. Examples and commentaries may be found in:  
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Alain Bonnafous, "The Regional Impact of TGV," *Transportation* 14:2, 1987.  
John Peterson and Graham Wall, "The ex Ante and ex Post Economic and Social Impacts of the Introduction of High Speed Trains in South East England," *Planning Practice and Research*, 23:3, 2008.  
Moshe Givoni, "Development and Impact of The Modern High Speed Rail Train: A Review," *Transport Reviews* 26:5, 2006.
9. Yasuo Wakuda, "Railway Modernization and Shinkansen, Japanese Railway History 10," *Japan Railway and Transport Review* Vol. 11, 1997.  
Christopher P. Hood, *Shinkansen, From bullet train to symbol of modern Japan*, Routledge, Taylor and Francis Group, London, 2006.
10. See for example, Roderick A. Smith, "The Japanese Shinkansen, Catalyst for the renaissance of rail," *Journal of Transportation History*, 24/2, 2003.
11. The Kakegawa Shinkansen station opened in 1988.
12. Japanese prefecture revenue is a complex of federal transfers and local taxes. Nevertheless, the variation in revenues related to economic events is primarily a consequence of business and consumption taxes at the local level. See Jerry Nickelsburg and Saurabh Ahluwalia, "High Speed Rail and Induced Economic Development: The Case of