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Oligopoly Strategy and the Timing of American Railroad Construction: Or Why Were All the Railroads in Kansas Built in 1887?

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OLIGOPOLY STRATEGY AND THE TIMING OF AMERICAN RAILROAD CONSTRUCTION: OR WHY WERE ALL THE RAILROADS IN KANSAS BUILT IN 1887?

by

C. Knick Harley

ABSTRACT

The railroads in the American West were constructed in a few concentrated building booms. This timing of construction resulted from the alternate creation and collapse of imperfect property rights to potential lines in partially settled areas. These "property rights" arose from strategic behavior within the railroad oligopoly. When enforcement costs of cooperative action were low, the railroads were able to create rents by avoiding construction ahead of demand. When enforcement became difficult, however, construction was the only way to capture rents on unbuilt lines so a construction boom ensued.

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Why were the American railroads built in a series of remarkably concentrated construction booms (see Figure 1)? These booms represented rapid expansion of the railway network at the western frontier (Harley, 1980, pp. 234-235). In the particularly spectacular building boom from 1886 to 1888, for example, some 6000 miles of new railroad track were laid in the states of Kansas and Nebraska alone. This amounted to about half of the mileage ever built in these states and virtually completed their railroad network. This mileage was not made necessary by the indivisibility of transcontinental main lines. These main lines had been completed, with the aid of federal land grants fifteen to twenty years previously. Rather this frenetic activity consisted of a few major railroad corporations building branch lines to service agricultural areas. In some of the countryside through which they built, agriculture was already well established; other areas would remain virgin prairie for a generation. The boom in railroad building did not follow or anticipate any sudden spurt of settlement. From before the Civil War until the First World War agriculture spread through these states steadily from the east to the west. Nor did the world market for grain, the region's staple export, provide justification for the sudden expansion. The Chicago price of wheat had fallen by over a third from its 1882 peak by 1886.

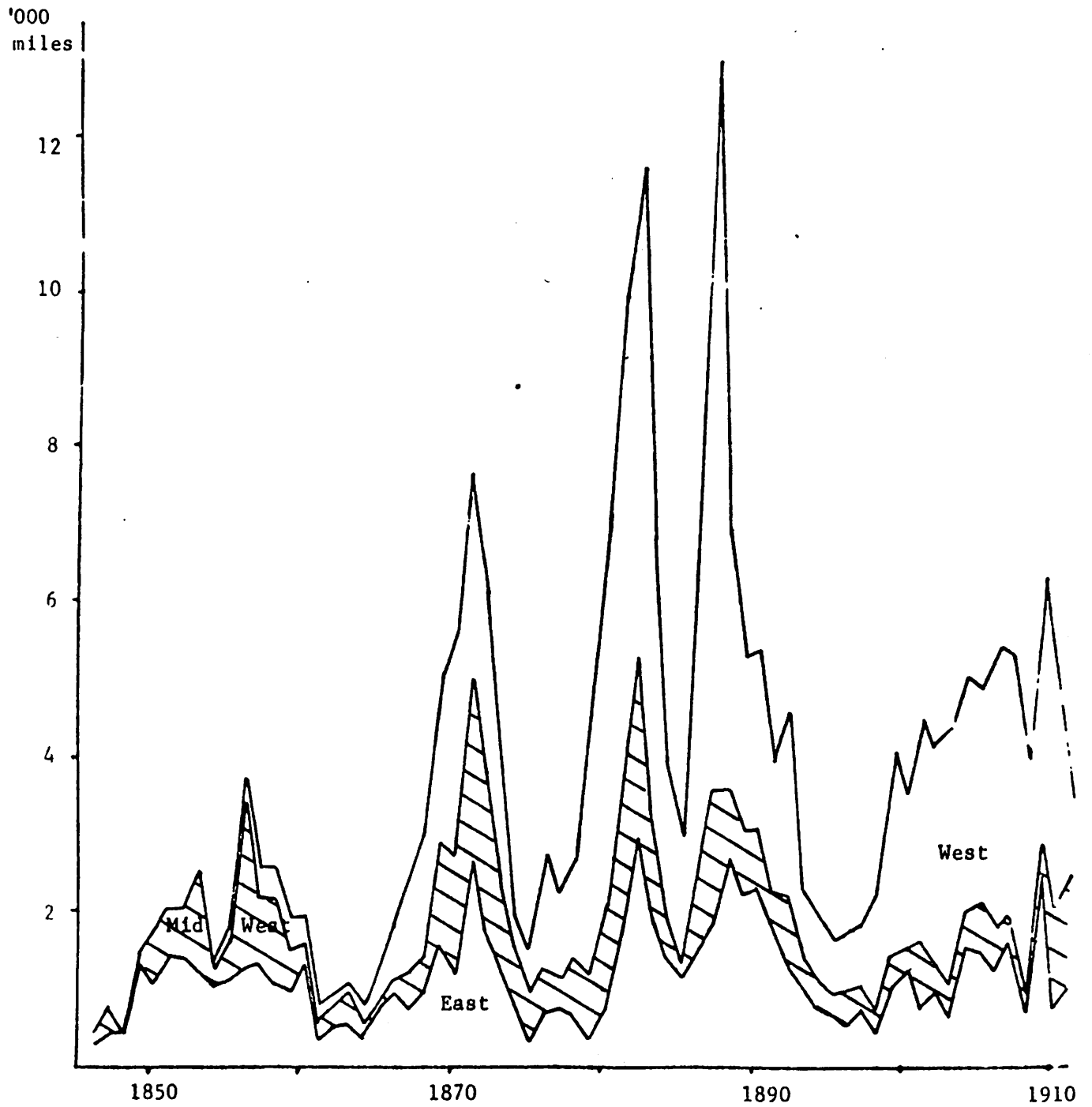
The temporal concentration of the massive capital mobilization that the construction of American railway entailed seems to have influenced the pattern of late nineteenth century American growth. The alternating periods of intense railroad construction and quiescence are systematically, and probably causally, related to the Kuznets' Cycles in American growth and the associated long swings in international capital movements. Railroad

investment and associated building booms in western cities were the clearest manifestation of the American long swing (Isard 1942a, 1942b; Hall 1968). The bonds issued to finance railroad construction were the principal vehicles of international capital movement (Simon 1967).

These booms and slumps in railroad construction appear to have had their origin in strategic behavior of firms within the oligopolistic structure of the railroad industry, rather than in changes in demand, technology or factor prices. In particular the railroad construction was delayed when the western railroad companies were temporarily able to create territorial property rights to future railroad lines. The building booms arose when these property rights collapsed under the weight of higher enforcement costs and greater incentives to cheating and to outside entry. Underlying the strategic creation of property rights lay the issue of the optimal timing of indivisible investments in a growing economy. The optimal timing of railroad construction has been dealt with somewhat in the historical literature within the framework of whether the American railroads were built ahead of demand. Much of the traditional literature has asserted that many of the American western railroads were built to anticipate and stimulate future traffic and failed to cover their capital costs in the early years. Such an investment, if properly timed, would have a zero net present value and thus be competitive with alternative uses of capital in the economy. However, if a property right to the (future) railroad line could be established, postponing construction until existing settlement would generate income to cover both operating and capital costs would maximize present value and create a rent that could be captured by the holder of that property right. In the American west the small number of railroads in a region were able to create temporary

Figure 1

Railroad Mileage Added 1846-1911



but not permanent territorial property rights. While these property rights prevailed little construction occurred. When these temporary property rights collapsed a building boom ensued as railroads captured all available rents (and dissipated potential rents) by constructing lines thus establishing firm property rights.

This explanation of the cycles of construction arising from the instability of strategic agreements among railroads seems to provide a superior explanation to the more usual discussions. One prominent line of argument has related the fluctuations in construction to Wall Street events. The low rate of construction in the 1870s is seen as a consequence of the crisis of 1873 while the booms of 1880s are attributed to the rising stock market (Davis et al, 1972, pp. 502-3). Such an analysis is superficial since it fails to explain why financially strong companies, like the Chicago, Rock Island and Pacific Railway and the Chicago, Burlington and Quincy Railroad, which both possessed extensive reserves and unquestioned credit in the 1870s failed to build in the 'seventies but undertook massive construction programs in the 1880s. A second commonly held view suggests that the cyclical expansion of the railroad network was generated by an interaction between frontier settlement and the markets for the export commodities of the frontier. In this view, the price of the staple export, wheat in the northwest, would control the cycle. A high price of wheat led to an expansion of the railroad network and of settlement. As a result of indivisibilities and excessive optimism, railroad construction, settlement and wheat production expanded and the price of wheat was driven down. Price remained low until demand growth absorbed the output that indivisible expansion of the railroad and distribution network has made available under

elastic conditions of supply. Eventually supply, given the existing railroad network, became inelastic and price rose. These higher prices then set off a new round of expansion (North 1956, pp. 11-14 and 1961, pp. 66-74). The variation in the price of wheat between 1850 and 1913 offers some support to this view, but more detailed analysis demonstrates that this view provides an inadequate explanation of the extreme concentration of western railroad construction.

The Economics of Building Ahead of Demand; and of Not

The profitability of railroad construction in frontier areas was obviously a function primarily of the level of the settlement in the region that generated a demand for traffic. Settlement, in turn however, was heavily dependent on the availability of low-cost transportation. This relationship has led to suggestions that the railroads built ahead of demand, i.e., the revenue from shipping was less than the full cost, including interest and depreciation on capital in initial years and subsequently grew to make the investment profitable. Albert Fishlow (1965, Ch. IV) in his justly famous study considered this contention with respect to the railroads built between the Ohio River and Chicago before the Civil War, and concluded that these railroads were not built ahead of time. The force of this demonstration has led many to doubt the importance of "building ahead of demand" in American railroads. To understand the issue it is important to analyze the economics involved.

The building of a railroad was a decision to undertake an investment. An investment is worth undertaking when the discounted present value of future revenues exceeds present discounted costs (except if that investment precludes an alternative investment with a greater net present value). In

the case of frontier railroads the expected revenues were growing through time as settlement took place, relatively slowly in the absence of a railroad and more rapidly after the railroad was constructed. If, when the area was completely settled the revenue from a railroad line would exceed its full cost (including interest and depreciation), the present value of revenues would exceed the present cost of construction before the current revenue exceeded full cost. It would pay to build ahead of demand.

Consider, as an example, settlement in Kansas in the 1870s and 1880s. Thirty-nine of Kansas' 105 counties did not receive their initial railroad line in the late 1860s and early 1870s when land grant railroads were built across the state. Since agricultural data are available for Kansas by county after 1874,[1] it is possible to estimate the growth of cultivated agricultural acreage, and by inference of potential railroad revenue. (This is the relevant calculation since the investment boom in the 1880s was not the construction of mainlines, but rather of branches.) The data were used to estimate "S"-shaped logistic growth equations for the counties without railroads and for a sample of five counties in central Kansas that already had railroad connections. The counties with rail connections grew somewhat more rapidly but not spectacularly so. With a railroad the logistic equation for growth of cultivation was

$$Y = \frac{1}{1+e^{-.14t}}$$

and without a railroad the logistic was

$$Y = \frac{1}{1+e^{-.1t}}$$

where Y is the proportion of the maximum cultivated acreage under cultivation and t is the time chosen so that t = 0 when Y = .5. These growth curves imply,

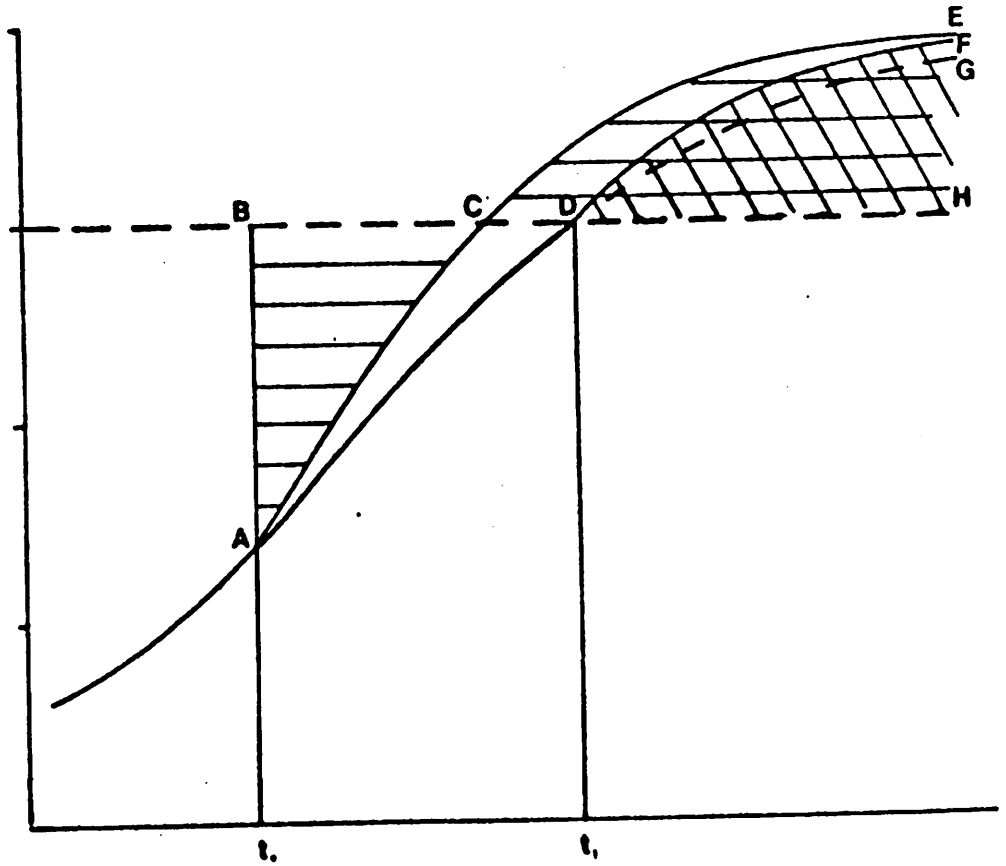
for example, that if two counties both were one-quarter settled, in the county with a railroad land under cultivation would double in eight years, while in the county without a railroad cultivated area would have increased by about two-thirds in the same period.

A simple example of the investment timing for branch lines can be constructed from these settlement growth paths and appropriate interest rates and final revenue levels. For simplicity the location of the line may be taken as predetermined by geographical considerations. Also for simplicity assume that earnings net of operating costs followed the same time path as settlement. Kansas data also suggest that the final annual earnings net of operating costs of a branch line was about eight dollars for every hundred dollars of initial capital investment. Finally an interest rate of six percent can be used as an opportunity cost of capital.[2] In this example, the present value of a potential railroad line would become zero when the area was thirty-five percent settled. At that point the net annual earnings per hundred dollars of capital invested would be $3.50. The annual opportunity cost of that capital of $6.00 would be earned only when the area was three-quarters settled and thus earning three-quarters of its final net revenue. In this example, this level would be reached after twelve years of operation "ahead of demand." During this period outside funds would have to contribute towards the interest cost of the capital in the railroad line. This investment would, however, be profitable since the period of loss would be compensated, with interest, by the subsequent period when revenue net of operating costs exceeded the interest on capital initially invested.[3] (See Figure 2.)

Since traffic increased as settlemtn grew after the railroads were built, the present value of a railroad became positive before the traffic

Figure 2

Illustration of Income and Investment
"Ahead of Demand" and at Maximum Present Value



Notes:

BCDH	= level of annual capital cost.
ADG	= level of net potential income without railroad.
t_o	= date P.V. = 0.
ACE	= level of net revenue with railroad built at t_o.
ABC	= losses during early period of operation.
CEH..	= profits during subsequent operation (P.V. ABC = P.V. CEH...).
t_1	= date P.V. maximized.
DFH..	= profits during operation if P.V. maximized.

could bear the full cost of investments. There is a clear motivation for rational investors to "build ahead of demand". The question then arises why didn't railroads always build ahead of demand? Fishlow's well-documented case between the Ohio and Chicago arose because of historical accident. The settlers got there before the railroad was available as an investment. There are, however, aspects of the investment decision that could lead the railways to avoid building ahead of demand.

Railroad building was a case of what Steven Marglin (1963) has called a dynamic investment decision. Building a railroad serving agricultural land some 10 or 15 miles on both sides of the line in, say, Kingman County, Kansas, was a once-and-for-all decision. In particular, it precluded building that line at some later date. Now an investment is optimally undertaken when its present value becomes non-negative only if it does not preclude an alternative investment of a higher present value. In fact, building ahead of demand does preclude a more valuable investment. The present value of the right to build the line at some future date has a positive present value before the present value of building becomes non-negative and exceeds the present value of building so long as current revenue does not cover capital costs. The optimal decision consists of building when the present value of building attains a maximum. This will occur when settlement has grown to allow net traffic revenue to cover both the operating and the capital costs of railroad. The optimal decision precludes building ahead of demand.

In the numerical example considered above, a rational investor would not have paid anything for the right to build at the date when settlement reached 35 percent, for that action had zero present value. Such an investor would, however, have paid just over an additional 15 percent of the eventual cost of actual construction for the right to build the line 17 years later.[4] At that

date settlement would reach three-quarters of its ultimate level and thus the present value of the investment would reach a maximum.[5]

An exclusive right to build a line in the future thus was valuable--it yielded a potential rent. Such a right did not, however, exist in law. Popular opinion in the west was practically unanimous in its support for early railroad construction. Thus a legal right to delay building would never have been politically possible even though it would have been economically efficient.[6] A weaker property right in potential railroad lines, however, could develop out of the oligopolistic structure of the railroad industry. The changing costs of the enforcement of such an imperfect property right would provide a convincing explanation for the relative absence of railroad construction in the 1870s and the concentrated building booms of the 1880s.

The nature of the investment decision makes it clear that any railroad had an incentive to avoid construction of a line ahead of demand if it could be sure of retaining the right to build that line at some future date. Under conditions of competitive construction, however, the incentives were to build railroads when their present value became non-negative for any rents created by delay could be captured by a competitive firm building the line which was unprotected by a property right. The avoidance of building ahead of demand thus hinged on a property right to future construction. In the case of the American west that right was not legally enforceable but rested on a cooperative game-theoretic arrangement that was subject to the instability that characterizes such agreements. Understanding the maintenance and the collapse of the territorial rights that allowed the railroads to avoid building ahead of demand must focus on the costs of enforcing agreements among potential builders regarding territorial rights and the individual

benefits to non-collusive behavior; and on how these changed in the course of the 1870s and 1880s. When enforcement costs and benefits of non-collusive action were low the railroads did not build potential lines where present values were positive but whose immediate revenues would not cover full costs. However, when the enforcement costs of agreements and benefits of non-collusive action rose, a situation developed where every company perceived lines with positive present value to be in peril of being lost to some competitor who would choose to build first. The only way to capture or hold the positive present value was to build and so a building boom ensued.

The Prisoners' Dilemma of Construction and the Maintenance of Collusion

American western railroads by the 1870s were an obvious oligopoly. In any particular geographic region potential rivalry was limited to about three companies. Main lines had been built but feeder lines to serve many large potential agricultural areas remained to be built. The barriers to outsiders constructing railroads on or near the frontier were formidable. Any new entrant had to obtain main line connections either to a port or to the eastern trunk lines--usually at Chicago or St. Louis. This meant that a new entrant had to build 400 or 500 miles of main line, duplicating existing service, in conjunction with the local lines at the frontier. Thus by the early 1870s there were only two or three railroad companies that could reasonably build in most areas.

The few competing railroads in a geographic area found themselves in a "Prisoners' Dilemma" with respect to new construction. Collectively the railroads maximized their profits by not building any line until its present value reached its maximum. But individually each railroad would be best off, assuming its rivals' actions given, by building all lines it perceived

to have a positive present value. The railroads were aware of their interdependence and there is evidence that they consciously pursued the joint maximization solution. The viability of that solution depended on two conditions: first, on the barriers to outside entry, and second, on the enforceability of the collusive agreement. Both enforcement costs and entry barriers changed in such a way as to make cooperative behavior more difficult as agricultural settlement proceeded. First, as existing companies delayed construction of branch lines, the benefits of entry grew relative to the costs of providing main line connection; thus the incentive for outside entry, particularly by railroads in adjacent regions, grew. A second threat to the maintenance of the cooperative optimum among the existing companies arose from specifying and enforcing the cooperative outcome. Enforecement costs differed sharply in different conditions. When many potential lines in a large area had a positive present value but none of those present values had reached a maximum, the joint profit maximization implied that no lines should be built in the area. Such an agreement was easily policed and thus easily enforced. It was remarkably difficult to build a railroad line across the Kansas prairie without anyone noticing. It was not even possible to start to build such a line without attracting attention. Thus an agreement not to build at all was easy to enforce. When, however, the collective optimum dictated that some lines be built, policing became much more difficult and enforcement costs rose. If lines were to be build, territorial rights of different companies had to be specified with a precision that had previously been unnecessary. This obviously involved harder decisions. Secondly as lines were built into territory between the existing lines of rival companies, cheating became easier.

Thus the maintenance of a cooperative optimum which was relatively easy when the present value of some lines became positive but none had maximized became harder as agricultural settlement increased. The rising present value of potential lines became more attractive to outsiders and the cost of policing and maintaining agreement among existing firms grew dramatically as the joint optimum came to involve some construction. Under these conditions, in particular, in the late 1870 and 1880s and again in the early twentieth century, the cooperative strategy in a geographic area broke down and the railroad companies built all the lines whose expected present values were positive. Thus a period of cooperative strategy of not building lines whose present value had not maximized--a decade of little building--was followed by a breakdown of that strategy. When the cooperative strategy could no longer be maintained in the face of both sharply rising internal costs of agreement and enforcement and increasing incentive to outside entry, each railroad pursued the non-cooperative strategy of building all railroads with positive present values. Thus the railroad construction booms. In the aftermath of building booms as, for example, in the early 1870s and in the mid-1880s in the Northern Plains cooperation in a joint maximization strategy of not building could be re-established.

The Spatial Pattern of Settlement and the Incentives for Railroad Building: Detailed Consideration of Kansas

The building of railroads in the American west was essentially tied to the spatial expansion of cultivation. Until the end of the nineteenth century transportation costs for bulky agricultural commodities were considerable relative to their value in final markets. The consequence of this was a fairly steep rent gradient that determined the extensive margin of cultivation and thus the geographic extent of a profitable railroad network.

The extensive margin was extended in the late nineteenth century by increasing world population that increased demand, and particularly importantly by falling transportation costs (Harley, 1978, 1980).

Spatial aspects of the timing of settlement, and thus the demand for railroads, may be illustrated by considering the distribution of wheat prices in Chicago and in Kansas counties and their relationship to transportation costs.[7] For example in the early 1880s (over 1880-83) the price of wheat in Chicago was about $1.10 a bushel (its high for the late nineteenth century), in the eastern counties of Kansas the price was 96¢ and some two hundred miles west on what was then the far frontier along the 99th meridian the price was 80¢. These price differentials quite closely reflect the published freight rates on the railroads of 24¢ per 100 lbs. (14¢ per bushel) from Missouri River points to Chicago and an average of 2.6¢ per ton mile (15.6¢ per bushel for 100 miles) that trans-Missourian railroads were earning. These wheat prices at the peak of the boom of the early 1880s almost certainly provided farmers a surplus over the cost of production at the 99th meridian and beyond (Kansas extends some 150 miles west to just beyond the 102nd meridian) but a reasonable settler could hardly have been confident that these prices would persist. The long-run trend price in Chicago was about 97¢. At this price, land on the 99th meridian was probably near the extensive margin,[8] and areas further west were beyond that margin.

Not surprisingly, settlement proceeded across Kansas' 400 miles gradually from east to west. In some of the eastern-most counties the cultivated area reach 40% of the total area ever brought into cultivation by 1875. Between the 98th meridian and 99th meridian in the middle of the state, 40% of the land was under cultivation a decade later and in the far northwest

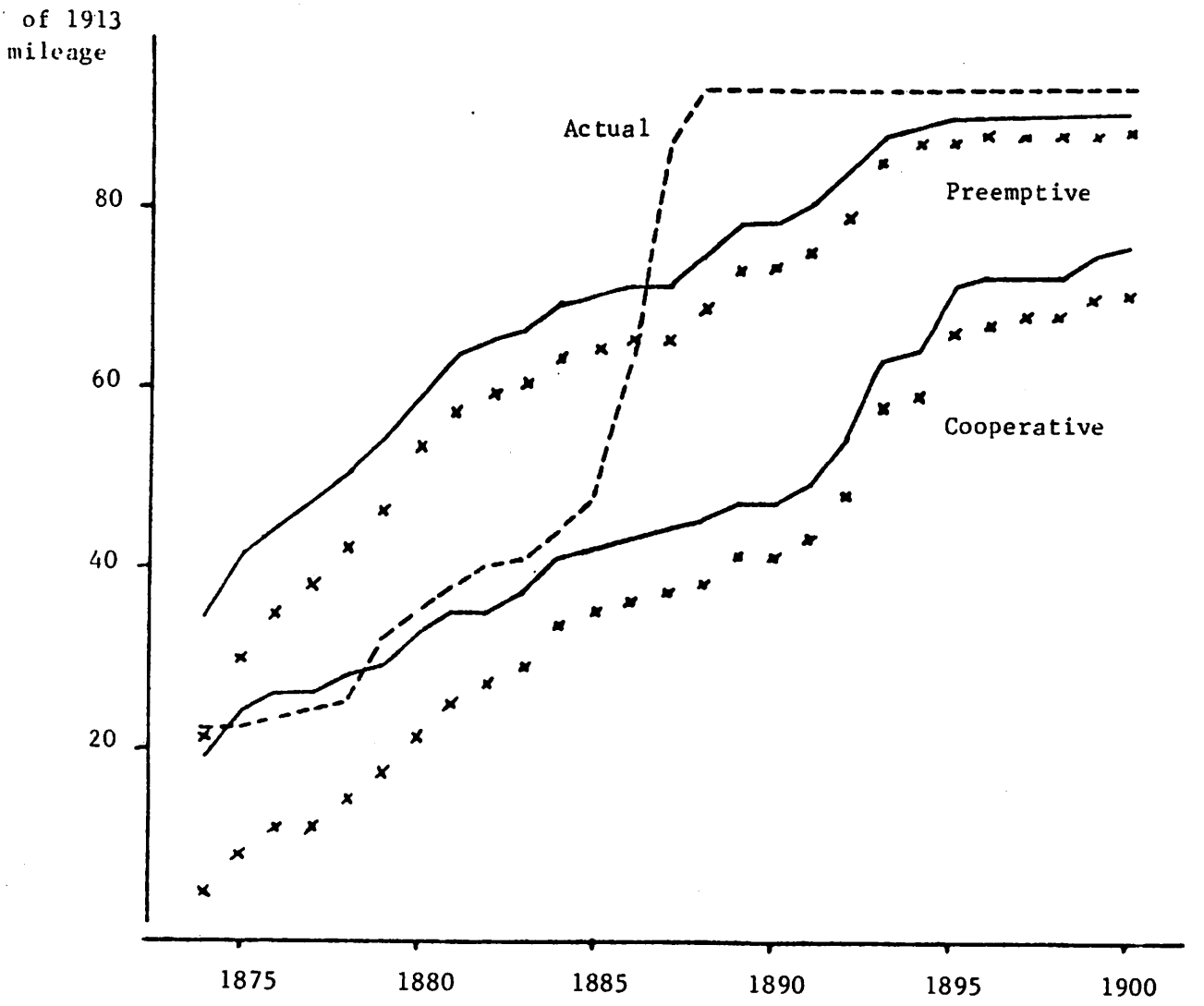
of the state that level of cultivation was achieved after still another decade. The very dry areas in the extreme southwest of the state reached that level of cultivation only after the First World War.

This gradual settlement of the state implied that the profit opportunities for railroad lines gradually improved from east to west. In the absence of an enforceable agreement to delay construction and the subsequent collapse of that agreement the great concentration of railroad building in 1886 and 1887 would not have occurred. We can demonstrate that in the absence of this imperfect property right railroad construction would have proceeded more smoothly by applying data on agricultural settlement county-by-county in Kansas to the model of the timing of railroad building developed above. The investment example indicates that under reasonable assumptions the present value of a railroad in an area became zero when traffic reach about 35 percent of potential, and the traffic would cover all costs, including capital costs, when traffic equalled 75 percent of potential. Since each county in Kansas ultimately had approximately two railroad lines, we might reasonably assume that one of these lines would have a present value of zero when the county was about 20 percent settled, allowing for concentration of settlement along a potential route. The second line would have zero present value when the country was about 40 percent settled, allowing for greater concentration along the existing route. By the same token we can illustrate the expected timing of construction when present value was maximized by predicting that one line would be build when the county was 40 percent settled and the other when it was 80 percent settled. Those two hypothetical time paths of railway mileage and the actual mileage of railroads in Kansas are plotted in Figure 3. Both hypothetical paths lack the great jump in the mid-1880s.

The actual railroad mileage appears to follow the lower, joint maximization path from 1875 to 1885 and then jumps to the higher path and beyond in the late 1880s. The late 1880s level of railroads might, however, be viewed as an appropriate non-cooperative quantity for an optimistic projection of the rate of growth of demand during the early 1880s. Needless to say the calculation of the hypothetical time paths involves a considerable number of assumptions and must not be regarded as more than indicative. The result nonetheless is revealing of the change in behavior involved in the 1880s construction boom.

Figure 3

Actual and Predicted Railroad Mileage,
Kansas 1874-1900



Notes: The mileages predicted by the model are plotted with x's on the diagram. By 1873 a considerable railroad network had been constructed in response to land grants. These lines in each county have been identified by inspection of Poor's Manual and if their construction was not yet predicted they have been added to generate the solid lines on the Figure.

Extension of the Quantitative Argument from Kansas to the Small Grain Region of the U.S.

The preceding illustration of the desired railway network in Kansas can be extended to the States in the central and upper west (i.e., Iowa, Missouri, Minnesota, Kansas, Nebraska and the Dakotas). This extension utilizes the detailed county by county calculations for Kansas to estimate a relationship between the cultivated area for the state at various stages of settlement and the railroad mileage desired under cooperative and competitive conditions. These relationships are presented in Table 1.

Table 2 summarizes the extent of cultivated area and the relationship between cultivated area and railroad mileage for western states as key cyclical dates between 1867 and 1893.[9] The ratios of railroad mileage to settlement declines in every state between 1873 and 1878 and then jumps dramatically either between 1878 and 1883 in the case of the states in the northwest or between 1883 and 1887 in states of the central west. This suggests that construction is following neither a competitive "building ahead of demand" path nor a cooperative path consistently throughout the period since a cooperative path would be characterized by a continuously rising ratio of miles per cultivated acre and a pre-emptive path by declining miles per acre.

Table 3 attempts to predict mileage of railways in the various states at various dates under the two suggested investment strategies by using the actual cultivated acreage in the state and the relationship between mileage and acreage derived from Kansas county data. These figures suggest quite strongly that in the older settled areas of Iowa and Missouri the railroad

TABLE 1

Degree of Settlement and Railroad Mileage per Cultivated Acre "Building Ahead of Demand" and "Cooperatively" Smoothed Data from Kansas Example, 1867-1911

Percent Settled	Miles Per Acre Building Ahead	Miles Per Acre Cooperative
10	.99	.20
20	.93	.26
30	.87	.31
40	.81	.36
50	.76	.40
60	.70	.43
70	.66	.47
80	.61	.49
90	.57	.52
100	.56	.56

Notes: [1]The predicted miles per acre with "building ahead" were smoothed by a regression of the ratio on the log of settlement.

[2]The predicted miles per acre with "cooperation" were smoothed by a regression of the log of the ratio on the log of settlement.

TABLE 2

Degree of Settlement and Ratio of Railroad Mileage to Cultivated Acreage

Western States Key Dates 1867-1893

	Iowa		Missouri		Minnesota		Kansas		Nebraska		North Dakota		South Dakota	
end of	Degree of Settlement	Miles per Acre	Degree of Settlement	Miles per Acre	Degree of Settlement	Miles per Acre	Degree of Settlement	Miles per Acre	Degree of Settlement	Miles per Acre	Degree of Settlement	Miles per Acre	Degree of Settlement	Miles per Acre
1867	.22	.36	.23	.43	.09	.51	.02	1.62	.01	2.98				
1873	.47	.49	.42	.62	.23	.80	.11	1.16	.06	1.37				
1878	.56	.46	.56	.54	.36	.66	.28	.52	.20	.47				
1883	.67	.66	.86	.49	.47	.80	.40	.60	.38	.53		.07	1.57	
1888	.72	.72	.90	.60	.58	.92	.53	1.01	.51	.72		.30	.68	
1893	.86	.61	.92	.61	.70	.81	.70	.77	.77	.53	.30	.63	.56	.55

companies were able to capture some significant portion of the rents available from avoiding construction ahead of demand. Closer to the frontier in Minnesota, Kansas and Nebraska, the mileage is close to the competitive mileage. Care must be taken, however, before asserting that this mileage implies the absence of oligopolistic understanding since the railroad construction in the west was heavily stimulated by Federal Land Grants. These grants required immediate construction and undoubtedly accelerated construction between the Civil War and 1873. The importance of land grants is clearly indicated by the data in Table 4.

The calculations presented in Table 3 suggest that the western railroads were able to avoid building ahead of demand, except under the incentive of Federal Land Grants, until the late 1870s. That pattern of cooperative behavior, however, did not persist through the 1880s. By 1883, Minnesota and Iowa had a railroad mileage consistent with competitive construction ahead of demand and mileage in the Dakotas was approaching that level. Some construction had occurred in Nebraska and Kansas but the railroad mileage remained well below a level predicted by competitive construction. The upsurge of construction in 1886 and 1887 ended this situation and by the end of 1888 all these western states had built ahead of demand.

The great concentration of construction in the 1880s seems to have been the result of the breakdown of territorial understandings among the railroad companies in the west. Table 5 and Figure 4 illustrate and compare the actual construction with hypothetical situations in which there was either persistent building ahead of demand of all lines with non-negative

TABLE 3

Actual and Predicted Railroad Mileage
Western States 1867-1893

	Iowa	Mo.	Minn.	Kansas	Neb.	No. Dak	So.	Total
Dec. 1867:								
Actual	1283	1085	482	494	473	0		3817
Building Ahead	3242	2303	932	307	159			6943
Cooperative	1304	709	188	61	32			2294
Dec. 1873:								
Actual	3728	2858	1950	2100	1107	275		12018
Building Ahead	5940	3686	2194	1779	807			14406
Cooperative	2970	1705	651	363	160			5849
Dec. 1878:								
Actual	4206	3286	2535	2427	1314	320		14088
Building Ahead	6595	4469	3196	4082	2563			20905
Cooperative	3704	2510	1294	1392	717			9617
Dec. 1883:								
Actual	7216	4619	3906	3964	2696	2493		24894
Building Ahead	7260	5586	3809	5383	4206	1586		27830
Cooperative	5170	4734	1905	2392	1773	317		16291
Dec. 1888:								
Actual	8305	5901	5375	8755	4980	4465		37781
Building Ahead	7526	5619	4380	6444	5151	5736		34856
Cooperative	5442	5148	2393	3570	2747	2044		21344
Dec. 1893:								
Actual	8513	6464	5947	8931	5542	2571	2792	40760
Building Ahead	7670	5619	4818	7676	6412	3461	3720	39376
Cooperative	6370	5150	3431	5466	4964	1233	2089	28703

TABLE 4

Federal Land Grants and Railroad Construction in Western States, 1865-1871

	Construction	With Grant	% With Grant
Michigan	2,417	909	38
Wisconsin	1,418	265	19
Minnestoa	1,833	1,715	94
Iowa	2,960	1,219	41
Missouri	1,955	384	20
Kansas	2,110	1,654	78
Nebraska	985	832	84
Dakota Territories	275	196	71
California	1,181	835	71
Oregon	232	227	98
Washington	110	106	96
Nevada	601	460	76
Utah	459	255	56
Colorado	682	298	44
Wyoming	459	400	87
Indian Territory	279	155	56
Arkansas	662	555	84
Louisiana	181	152	84
TOTAL	18,799	10,617	56%

Total Construction in U.S.: 38,715 miles of which western land grant railroads 27%; if Southern[1] and Texas[2] grants included 35%.

NOTES:

[1]On July 1, 1875 there were also 1435 miles of land grant railroads in the public lands states in the South (Florida, 247 miles; Alabama, 782 miles; Mississippi, 406 miles).

[2]Texas, unlike the other western states was not a "public land state". Extensive land grants were given by the state; of 1602 miles of railroad in the state in 1875, 1498 (92%) belonged to companies with land grants.

SOURCES:

From 1872 on the mileage of land grant railroad lines by states are available annually in Annual Report of the Commissioner of the General Land Office, U.S. Department of the Interior.

Construction prior to 1872 has been calculated on the basis of John Bell Sanborn, Congressional Grants of Land in Aid of Railways, Bulletin of the University of Wisconsin, Economics, Political Science and History Series, Vol. 2, No. 2 (1889), pp. 263-392, and mileage and date of construction data from Poors Manual of Railroads, various dates.

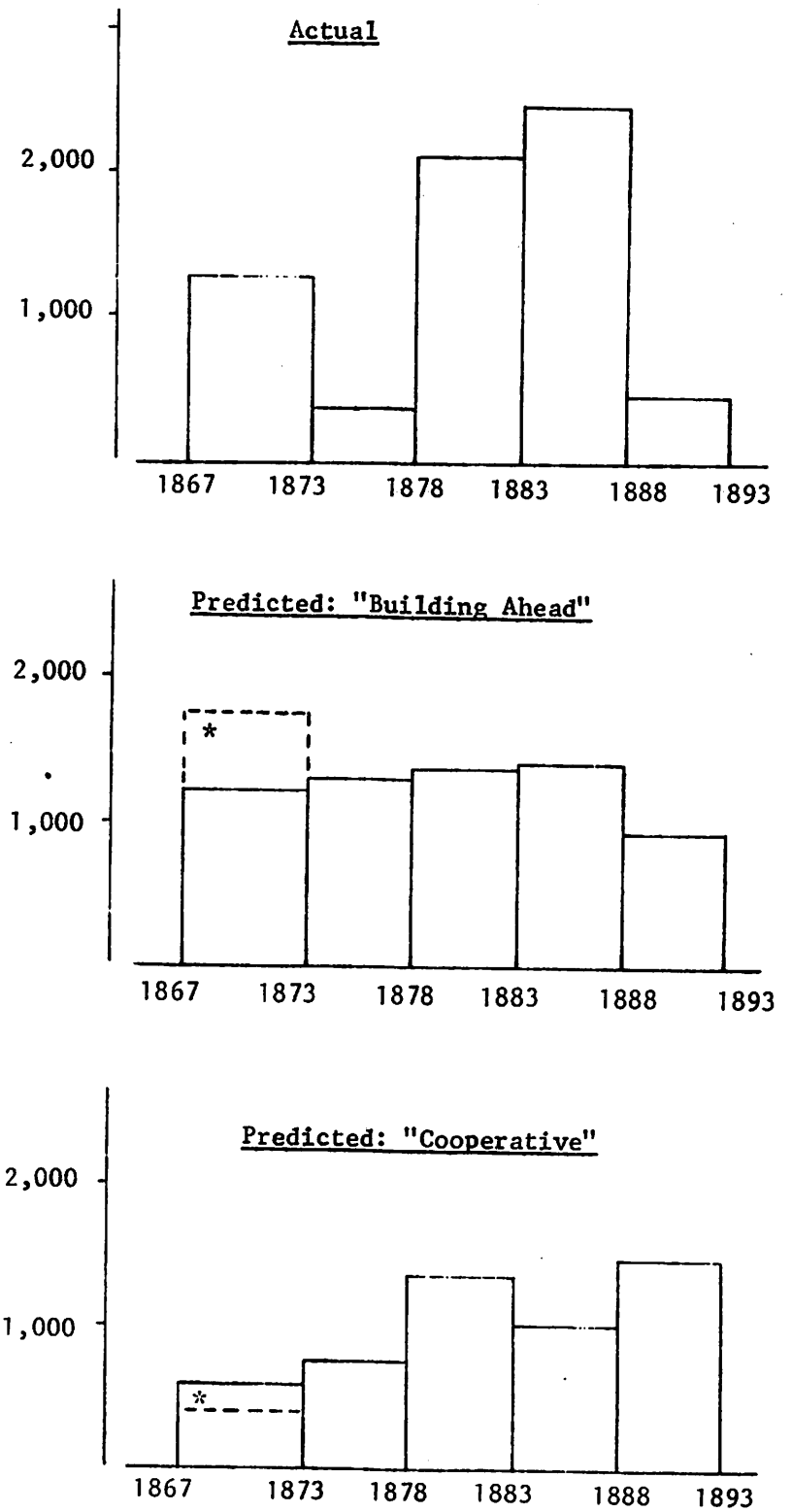
TABLE 5

Western Railroad Construction Actual and Under Regimes of "Building A Level of Demand" and "Cooperation" 1867-1893

1867-73	Iowa	Mo.	Minn.	Ka.	Neb.	Dak.	Total
Actual	2445	1773	1468	1606	634	275	8201
Building Ahead	2698	1383	1262	1472	648		7463
Cooperative	1666	996	463	302	128		3555
1873-78							
Actual	478	428	585	327	207	45	2070
Building Ahead	655	783	1002	2303	1756		6499
Cooperative	734	805	643	1029	557		3768
1878-83							
Actual	3010	1333	1371	1537	1382	2173	10806
Building Ahead	665	1117	613	1301	1643	1586	6925
Cooperative	1466	2224	611	1000	1056	317	6674
1883-88							
Actual	1089	1282	1469	4791	2284	1972	12887
Building Ahead	266	33	571	1061	945	4150	7026
Cooperative	272	414	488	1178	974	1727	5053
1888-93							
Actual	208	563	572	176	562	898	2979
Building Ahead	144	0	438	1232	1261	1445	4520
Cooperative	928	2	1038	1896	2217	1278	7359
1867-73 With actual 1867 mileage and 1873 predicted							
Building Ahead	4657	2601	1712	1285	334		10589
Cooperative	1687	620	169	0	0		2476

Figure 4

Western Railroad Construction, Actual and Predicted 1867-1893
Annual Averages, Various Intervals



*Broken line assumes actual rather than predicted 1867 mileage.

present value or of achievement of the cooperative strategy of building as present value maximized. Neither persistent strategy exhibits cyclical fluctuations similar to those that actually occurred.

Direct Evidence of Territorial Agreements and their Failure

Evidence of territorial understanding and their collapse is available in Julius Grodinsky's (1950, 1957, 1962) important archival research on railroad decision-making and interfirm relationships. Grodinsky observed that "many roads created territorial enclaves: mutually monopolistic areas, where each road agreed not to invade the territory of the other. These agreements were usually verbal understandings and were only infrequently reduced to writing. Sometimes they were examined and approved by the directors of the contracting parties, while other arrangements expressed only understandings reached by executive officers" (1962, p. 105). There seems little doubt that the railroads appreciated the value of the cooperative solution. On July 7, 1880 Charles E. Perkins, vice president, and soon to be president, of the Chicago, Burlington and Quincy Railroad observed in a letter to Jay Gould, then chief figure behind Missouri Pacific Railroad, with reference to a potential competitive building of lines in southern Nebraska, that "[t]here is probably more money to be made by not building them if we can agree as to the division of it." Grodinsky (1962, p. 114).

There is direct evidence of several agreements in the 1870s and more evidence of developing strains to the tacit agreement of territorial rights combined with understandings not to build by 1880. These latter strains sometimes were resolved by agreement and sometimes disintegrated into competitive construction. The best documented agreement in the 1870s was

connected with the successful arrangement between the Chicago, Burlington and Quincy; the Chicago, Rock Island and Pacific; and the Chicago and Northwestern to pool traffic transferred to and from the Union Pacific at Omaha. This "Iowa Pool" was the most successful American railway cartel and lasted, although not without strains, from 1870 to 1884. The pool agreement itself did not explicitly contain any division of territory within Iowa or elsewhere. During the early 1870s there had been some territorial struggles among the roads in Illinois. In Iowa, however, few branch lines were built between the main lines. In 1875, when Charles Forbes and his associates assumed principal managerial responsibility of the Burlington, "their first major act was to assure the Rock Island and the Northwestern that their true interests lay in Peace and in making the country pay [them] for [their] capital instead of going into competition and extending into each other's territory." (Grodinsky, 1950, p. 92.) This policy prevailed through most of the 1870s despite various crises, particularly between the Burlington and the Rock Island. North of the Rock Island Line, the Rock Island and Northwestern for a number of years followed policies of mutual respect for each other's territory. Still farther north between Chicago and St. Paul, the Northwestern maintained at least tacit territorial agreement with the Chicago, Milwaukee and St. Paul (Grodinsky, 1950, pp. 97-100). These were informal "gentlemen's agreements" that served to allow the pursuit of the collective profits from delaying construction.

The events that led up to the construction peak in 1883 are extremely complex in detail, but their cause and outcomes in different areas help to delineate the strategic situation the railroads faced. The expansion began

with the Chicago, Milwaukee and St. Paul's purchase of weak lines between its main line and that of the Northwestern (Grodinsky, 1962, Ch. VIII). The Northwestern general manager, Marvin Hughitt, responded by commenting on a rumor that the St. Paul was proposing to build to Des Moines, saying "it is simply a raid on the Northwestern and Rock Island lines, and would result evidently in such retaliatory measures as would make the scheme barren of all interest." This certainly was a plea to retain the cooperative policy. The St. Paul, however, evidently felt that the benefits of gaining positive present value from potential lines was sufficiently attractive and cooperation so costly that it proceeded with its building program. It built into many areas in southwestern Minnesota and in Iowa with sparse population and little immediate traffic. These were certainly lines whose present values were not yet at a maximum, but the St. Paul must have felt the present value was positive. By 1880, the Northwestern decided it could no longer remain idle and attempt to maintain a cooperative strategy as the St. Paul expanded its network into new areas. The Northwestern joined the expansion. The result was the construction of nearly 12,000 miles of rail lines in Wisconsin, Minnesota, Iowa and the Dakota Territories between 1878 and 1885. No more substantial building occurred in this region until the end of the century.

The strains to cooperative strategy that arose in the late 1870s were not confined to the territory north and west of Chicago, but the outcome in various areas differed. By 1879, both settlement in Iowa and Nebraska and the mining boom in Colorado had led to tension between the Union Pacific and the Wabash, both under Jay Gould's control, on the one hand, and the Burlington on the other. Gould threatened to build in southern Iowa and

to connect the Union Pacific to Chicago while the Burlington threatened to build through southern Nebraska to Denver. This conflict ended in a formal agreement dated August 26, 1880 between the Union Pacific and the Burlington by which both agreed to abandon their extension and promised "at all times [to] work in harmony." The agreement was to run for two years. In October 1880 the Wabash and the Burlington agreed to construct jointly a line in southern Iowa (its present value presumably had maximized). Despite strains, the cooperative solution appeared to have been maintained. This appearance, however, was to a large extent an illusion. Gould, with characteristic sleight of hand, was busy selling his interest in the Union Pacific and adopting the Missouri Pacific as his chosen instrument. In the summer of 1881, the Missouri Pacific began construction of a line from Kansas City to Omaha through southeastern Nebraska. The Burlington retaliated by constructing a mainline to Denver through the southern tier of counties in Nebraska. All out competition for branch lines did not emerge, however. Cooperation was maintained between the Burlington and the Union Pacific, now outside Gould's orbit (Grodinsky, 1957, pp. 240-244; 1962, Ch. IX).

In Kansas, territorial understanding was threatened in both the southeast and southwest at the end of the 1870s (Grodinsky, pp. 96-100, 162-178). In the east the St. Louis and San Francisco began to build from Joplin, Missouri to Wichita. The Atchison, Topeka and Santa Fe responded by building a large network of branch lines east of Wichita (most of whose present value had probably nearly maximized to judge by the population density in the area). In the summer of 1880 the Frisco and the Atchison agreed not to build in southern Kansas without consultation and to finance

jointly construction of the Atlantic and Pacific Railroad in Arizona and New Mexico.

The second potential source of conflict in Kansas arose between two Gould roads, the Kansas Pacific and the Denver and Rio Grande, on one hand, and the Atchison on the other. The conflict arose over access to the newly discovered mining area around Leadville, Colorado. This rivalry reached a dramatic high point in 1878: an armed clash at the Royal Gorge of the Arkansas River, the entrance to Leadville area--a victory for the Rio Grande--and the Atchison's successful physical control of Baton Pass and access to the southwest. There followed nearly two years of judicial and financial maneuvering that ended in an 1880 court settlement that included, among other things, an explicit territorial agreement between the companies. The Atchison agreed not to build north or west of Pueblo for 10 years and the Rio Grande agreed not to build in Atchison territory in southern Kansas. Thus territorial agreements held and were codified in Kansas. As a result railroad building in Kansas in the late 1870s and early 1880s was moderate.

The great building boom that peaked in 1887 was concentrated primarily in Kansas and Nebraska and is most easily explained in terms of a breakdown of the rather fragile agreements of the early 1880s. In Nebraska, the Chicago and Northwestern challenged and the Burlington responded. In competition, they laid most of the 2,000 miles built in the state and virtually completed the state's railroad network (from less than 50% of the 1913 level in 1885 to over 90% in 1889). In Kansas the construction boom was even more spectacular as Gould and his Missouri Pacific (under various corporate guises) drove into the middle of the state, the Rock Island

built south from Omaha and the Atchison responded in a mad rush to capture lines with positive present value. All together nearly 4,300 miles of railroad line were built in Kansas between 1885 and 1889 (from less than half the 1913 mileage to 95% of that mileage).

Alternative Explanations of Railroad Construction Timing

It is argued here that the concentration of railroad construction in the 1880's resulted from strategic behavior within the railroad oligopoly. In this strategic, or game-theoretic, situation there were two primary strategies resulting in different equilibrium railroad mileage. With joint profit maximizing, firms build only lines whose present value had maximized and were able to maintain the right to build other lines in the future; in a preemptive situation a company could obtain rights to a line only by building it, so all lines with positive present value were built. Had either of these strategic outcomes prevailed consistently the two railroad construction booms of the 1880s would not have occurred. These booms represent the abandonment of a cooperative strategy for a preemptive strategy in response to the increase in the cost of maintaining a cooperative strategy. This hypothesis arises from and rationalizes the narrative history of railroad construction. Furthermore it provides a satisfactory explanation for key quantitative characteristics of Western railroad construction in the 1870s and 1880s. The delay in construction despite rapid settlement after 1873 can thus be viewed as a strategic joint maximizing equilibrium avoiding "building ahead of demand". The booms in the 1880s were collapses of that equilibrium to a new preemptive equilibrium. The otherwise curious observation that the building boom of the early 1880s was largely confined to areas north and west

of Chicago while the boom of the late 1880s was confined to the central and southwest despite similar histories of settlement in the two areas is easily explained in this context by observing that spatial separation made these separate markets. Thus the cooperative equilibrium prevailed in the central west after its collapse in the northwest. Alternative explanations of the building boom seem inadequate, particularly in explaining the absence of construction in the 1870s and the differential timing of construction in the 1880s.

Douglass North's hypothesis essentially envisages a period of low product prices resulting from excess capacity terminating in rising product prices which trigger a construction boom that generates a new period of excess capacity. That propostion can be investigated by the use of time-series regressions. The process of railroad building may be modelled as an adjustment to a desired railroad network. The size of the desired network will be sensitive to the price of wheat (PR), the settled area (A), and the rate of interest (I). We assume a logistic adjustment to the desired stock (i.e., percentage change in the network is proportional to the ratio of the existing stock to the desired stock) which gives a regression equation with change in the log of railroad mileage as the dependent variables and the log of existing mileage as a right-hand-side variable along with logs of the determinants of desired mileage.

This regression model can be applied to two data sets. The first is the railroad mileage in the North Central Census region between 1857 and 1912. The railroad data are from Poor's Manual; the average of the three most recent years' Chicago price of wheat deflated by Kuznet's GNP deflator is used as

a price variable; U.S. Department of Agriculture estimates of area harvested in principal crops is used as a settlement variable; Macauley's yield on railroad bonds is the interest variable;[11] finally a Civil War dummy was introduced. A first-order autoregressive transformation was employed to correct for serial correlation. The estimated results suggest that the hypothesis has only limited power of explanation; the F statistic of 5.12 is not significantly different from zero at a one percent confidence level. (All variables in logarithms ($\Delta RR \equiv \log RR_t - \log RR_{t-1}$) t statistics below variables):

$$\Delta RR = \underset{(-.51)}{-.39} + \underset{(2.27)}{.16A} + \underset{(.85)}{.04PR} + \underset{(.37)}{.03I} - \underset{(-.31)}{.007\,CW} - \underset{(-2.90)}{.16\,RR_{-1}} \qquad (1)$$

$$R^2 = .27$$

The price of wheat and the interest rate are disappointingly insignificant and the interest rate has the wrong sign. Examination of the predicted values of railroad construction and actual construction also reveals the inadequacy of the model to explain fluctuations in construction. The periods of concentrated construction centered on 1870, 1880 and in 1886 and 1887 are large positive residuals, while the low construction in the late 1870s are negative residuals. Such explanatory power as the model possesses arises from the fairly obvious association of railroads with settlement and the prediction that if railroad mileage significantly exceeds its trend value there will likely be a period by low construction.

A second data set for the post-Civil War period yields similar results when state by state data on construction, settlement and wheat price are used in a similar regression.[12] Several experimental regressions were examined. The following is representative of the disappointing results. (Again all variables are in logs. PR is the local wheat price, PRC is the Chicago prices.)

$$\Delta RR = \underset{(-1.9)}{-0.4} + \underset{(2.7)}{0.02A} - \underset{(-2.6)}{0.07\ PR} + \underset{(3.3)}{0.12\ PRC} - \underset{(-2.8)}{0.06\ I} - \underset{(-6.6)}{0.9\ RR_{-1}} \quad (2)$$

$$R^2 = .30$$

The coefficients are significantly different from zero usually in the correct direction. The significant negative sign on the local price of wheat is disturbing but it is offset by the Chicago price. In general, however, the elasticities are small and the fitted equation fails to predict the building booms. Again most of the explanatory power of the equation comes from the lagged railroad mileage variable which has the effect of predicting small construction in the years following construction booms.

The mood of the financial markets in the 1870s and 1880s has perhaps been the most common explanation of the absence of railroad construction in the late 1870s and the boom of the 1880s.[13] In this view the financial crisis of 1873 that broke with the failure of the Northern Pacific and Jay Cooke and Company led to five years of suspicion toward railroad finance. Unfortunately the evidence of prices in financial markets are unable to confirm this view. In fact, a careful examination of the financial position of at least some leading railroads that expanded in the booms of the late 1870s and the 1880s seem to reject any simple financial explanation.

Certainly, the interest rate fails to explain the cyclical behavior of construction. The rate of interest of railroad bonds has a significantly negative coefficient in only one equation reported above. In neither case does it offer a substantial amount of explanation of construction fluctuations.[14]

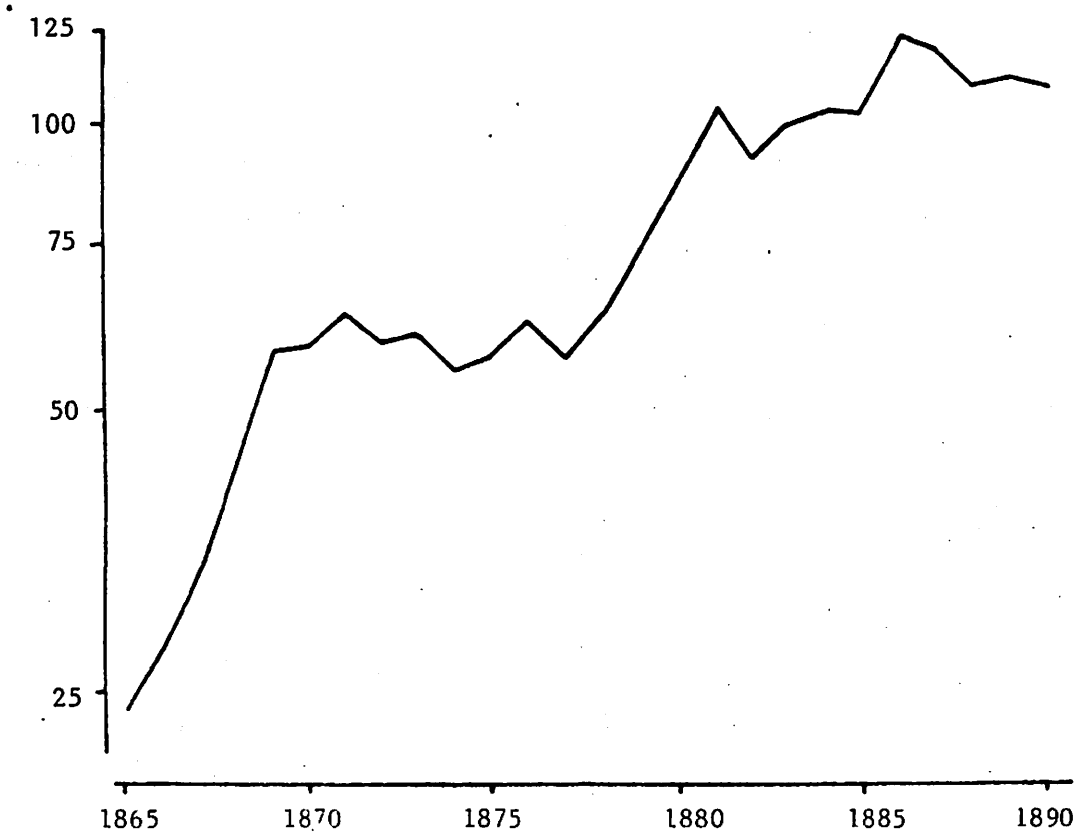
The price of railroad stock and bonds would seem to be the best indicator of the attitudes toward railroad securities. Contrary to what

the financial hypothesis, in at least its simplest form, would predict, the prices of railroad bonds were higher in the mid 1870s than they had been in the early seventies.[15] To be sure bond prices were higher still during the subsequent boom but such an observation fails to explain the key feature of the 1880s boom: the postponement of construction generally in the 1870s and in the central west until after 1885. The course of stock prices was similar. An index of the prices of the stocks of five leading western railroads (the Rock Island, the Illinois Central, the Burlington, the Alton and the Northwestern) deflated by the Warren and Pearson wholesale price index to remove the effect of the rapid decline in prices immediately after the Civil War (the Warren and Pearson index falls from 185 in 1865 to 135 in 1870 and then to 90 in 1879) is presented in Figure 5. The striking features of that figure are the market's substantial upward revaluation of railroad assets following the Civil War and then again after specie resumption in 1879. These revaluations certainly suggest changing investor evaluation of American railroads--probably by British investors--and warrant investigation in their own right. Nonetheless, financial distress does not seem to have prevented construction in the 1870s since stock prices retained their early 70s level in real terms. Nor can the course of stock prices offer insights into the differences in the timing of the construction booms in the Northern and Central plains.

The strong financial position in the 1870s of at least some of the railroads that undertook massive construction in the 1880s also casts doubts on the sufficiency of the financial explanation. Although weak railroad securities had difficulty finding a market in the mid and late 1870s, it is

Figure 5

Index of Stock Prices for Western Railroads, Deflated



important to realize that the construction of the 1880s was undertaken by established companies whose securities continued to be marketable at unchanging real prices.[16]

For example, the Chicago, Burlington and Quincy Railroad and the Chicago Rock Island and Pacific Railway each undertook as extensive construction as any company in the 1880s (each system increased its track mileage by over 2,000 miles) without having extended their lines in the 1870s. Both these lines maintained financial positions throughout the 1870s that would have easily supported construction. The Rock Island paid annual dividends of between 8 and 10 percent on its common stock throughout the 1870s; fixed interest and rental charges amounted to only about twenty percent of after-tax earnings; and the company carried a large and growing surplus account on its books. The Burlington's finances suffered only by comparison. The dividend rate remained at ten percent through the mid-1870s. Dividend payments comfortably exceeded interest and rental charges. A surplus was accumulated. Furthermore both these roads enjoyed support of wealthy eastern capitalists. The Burlington was owned principally in Boston by a group of wealthy individuals who followed John Murray Forbes (this same wealth supported and controlled the Atchison, Topeka and Santa Fe Railroad). The Rock Island was controlled and financed by New York wealth under the leadership of John F. Tracy. Neither of these lines was ever entirely dependent on the impersonal market for its funds. Much of the expansion of the 1880s was internally financed and when new securities were issued they were overwhelmingly subscribed to by existing stockholders. In any case these railroads maintained the confidence of anonymous capital through the 1870s.

It certainly seems unlikely that the timing of railroad construction in post-Civil War America can be explained without consideration of the strategic behavior of a small number of firms in an interdependent market. Financial considerations alone are insufficient to explain the timing, as the preceding discussion of the finances on the Rock Island and the Burlington indicate. It nonetheless seems likely that financial climate played a role in the strategic story that explains the concentration of building, since a hesitant stock market formed a barrier to entry for outsiders. The buoyant stock market of the early 1880s on the other hand, played a crucial role in Jay Gould's maneuvers that triggered the collapse of several cooperative strategies among the railroads in the Great Plains.

Conclusion

The concentration of railroad construction in the decades following the Civil War seems hard to explain by conventional hypotheses but seems well explained by a model that emphasizes the few companies involved in the railroad business in any geographical market and concentrates on the strategic behavior of these companies. Acting cooperatively the railroads maximized profits by avoiding building ahead of demand. In the absence of cooperation, each railroad maximized profit by building all lines with a positive present value--that is to say ahead of demand. In the late 1870s and in some areas in the early 1880s a cooperative strategy evolved and was maintained. The building booms, first in the Northwest in the early eighties and some five years later in the Central West, represented a sudden shift in strategies from cooperative behavior by the railroads to one of preemptive building as the costs of enforcement of cooperation rose and the gains to preemptive capture of unbuilt lines rose.

Footnotes

[1]The data from the Kansas Board of Agriculture are available in machine readable form made available by the Inter-University Consortium for Political and Social Research. The data for "Adjustments to Resource Depletion--The Case of American Agriculture--Kansas 1874-1936" were originally collected by William N. Parker, Stephen J. De Canio and Joseph Trojanowski. Neither the original collectors of the data nor Consortium bear any responsibility for the analysis or interpretations presented here.

For a candid assessment of the quality of these statistics see Malin, 1944.

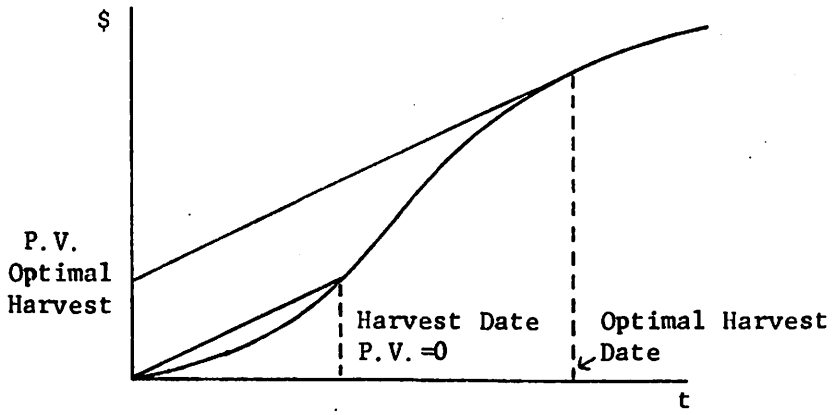
[2]These figures are illustrative, but fit the Kansas data fairly well. They are used for illustrative purposes throughout the paper. Fortunately the qualitative conclusions are not enormously sensitive to this exact specification of interest rates, final earnings and growth rates within a relevant range of values. Obviously more complex examples could be constructed but it seems unlikely they would significantly alter the results.

[3]These net earnings will, of course, be just paying the rate of interest (6%) on the total capital invested. This total capital is the sum of the initial investments and the foregone compounded interest on this capital.

[4]Seventeen rather than the twelve years of building "ahead of demand" mention above because settlement would grow more slowly in the absence of the railroad.

[5]This proposition is a very simple extension of the classical Austrian Capital Theory problem of the optimal date to cut a tree. If the value of the timber increases as the tree grows but at a decreasing rate then the optimal time to harvest is when the rate of increase in value equals the rate of interest. The present value of the timber at time zero, given otpimal harvest may be illustrated diagrammatically, by extending a line of slope (1 - r) from a tangency to the growth curve to the y-axis. This is a rental value of the timber land. The

present value of the growing timber becomes zero when a line with slope (1 - r) passing through the origin intersects the growth curve.



Although this proposition is generally known it is often not fully appreciated. See in particular Robert Fogel (1966, p. 152) where he accepts the zero net present value criterion. This was brought to my attention in Barzel, 1971, p. 216, n. 2.

[6]The efficiency, from a social point of view, of delay depends on an implicit assertion that railroad freight charges equalled long-run marginal cost. If monopoly pricing of rail services existed profit maximizing and efficient timing would, of course, diverge.

[7]These data are from: Chicago price: Harley, 1980, pp. 246-7; Kansas prices: Parker et al., 1978; Railroad rates: John Hyde and H. T. Newcomb, 1898 and pp. 20-28 and 48.

[8]97¢ in Chicago implies a local price of about 67¢ a bushel at the 99th meridian. The United States Department of Agriculture Yearbook 1893, pp. 515 and 517 estimate the cost of production of wheat, except rent, at between $7.00 and $7.50 per acre. Yield per acre in average years was between 13 and 17 bushels per acre in the mid-1880's and the general price level was some 20% higher than in 1893. These imply costs, excluding rent, of between 50¢ and 70¢ per bushel. Local price would be below 70¢ at the 99th meridian and near 50¢ at the west end of the state.

[9]The railroad mileage are from Poor's Manual of Railroads. The cultivated area is the sum of the area harvested in wheat, corn, barley and oats as estimated by the U.S.D.A.

[10]For a discussion of the details of this collapse see Grodinsky, 1962, Chapters XV and XVI.

[11]The data used in the regression are described in Harley, 1980. The Kuznets deflator has been extended to the pre Civil War period on the basis of Gallman's implicit deflator and the Warren and Pearson index. The regressions were also run using a real interest variable which was constructed by subtracting the average price change in the five previous years from the nominal rate. The interest variable remained insignificant. Inclusion of the price of rails yielded a positive regression coefficient.

[12]This is the same data set used in Harley, 1978.

[13]See, for example, Albert Fishlow's discussion in Lance E. Davis, et al., 1972, pp. 500-505.

[14]The same conclusion holds if a "real" interest rate is used.

[15]This conclusion is even stronger when allowance is made for expectations of price declines. Prices declined very rapidly shortly after the Civil War but rather more slowly by the mid-1870's.

[16]Thus the New York Times March 16, 1876 stated:

> "The fact that the money markets of Europe are now closed against new railroad enterprises emanating from this country is too palpable to be denied. The growing disposition to invest in our railroad securities, which has for some months been one of the characteristics of the London market, manifests itself only within very narrow limits. Investors confine themselves to well known and prosperous companies, whose capital affords ample security for money borrowed and the soundness of whose management has been attested by the uninterrupted payment of dividends during the hardest of hard times."

The Burlington and the Rock Island were two such "well known and prosperous companies".

References

Barzel, Yorem, "Investment, Scale and Growth," Journal of Political Economy 79 (1971).

Davis, Lance E., Richard A. Easterlin and William N. Parker, et al., American Economic Growth: An Economist's History of the United States. New York: Harper and Row, 1972.

Fishlow, Albert, American Railroads and the Transformation of the Ante-Bellum Economy. Cambridge, Mass.: Harvard University Press, 1965.

Fogel, Robert, "Railroads as an Analogy to the Space Effort: Some Economic Aspects," Economic Journal 76 (1966).

Grodinsky, Julius, The Iowa Pool: A Study in Railroad Competition, 1870-84. Chicago: University of Chicago Press, 1950.

Grodinsky, Julius, Jay Gould: His Business Career, 1867-1892. Philadelphia: University of Pennsylvania Press, 1957.

Grodinsky, Julius, Transcontinental Railway Strategy, 1869-1893. Philadelphia: University of Pennsylvania Press, 1962.

Hall, A. R., "Introduction," in A. R. Hall, The Export of Capital from Britain, 1870-1914. London: Methuen, 1968.

Harley, C. Knick, "Western Settlement and the Price of Wheat, 1872-1913," Journal of Economic History 38 (1978).

Harley, C. Knick, "Transportation, the World Wheat Trade, and the Kuznets Cycle, 1850-1913," Explorations in Economic History 17 (1980).

Hyde, John and H. T. Newcomb, "Changes in the Rates of Charge for Railway and other Transportation Services," United States Department of Agriculture Statistical Bureau Bulletin 15 (1898).

Isard, Walter, "A Neglected Cycle: The Transportation-Building Cycle," Review of Economics and Statistics 24 (1942a).

Isard, Walter, "Transportation Development and the Building Cycles," Quarterly Journal of Economics 57 (1942b).

Malin, James C., Winter Wheat in the Golden Belt of Kansas. Lawrence: University of Kansas Press, 1944.

Marglin, Stephen, Approaches to Dynamic Investment Planning. Amsterdam: North-Holland, 1963.

North, Douglass C., "International Capital Flows and the Development of the American West," Journal of Economic History 16 (1956).

North, Douglass C., The Economic Growth of the United States, 1790-1860. New York: Prentice-Hall, 1961.

Parker, William N., Stephen J. DeCanio, and Joseph Trojanowski, "Adjustment to Resource Depletion--The Case of American Agriculture--Kansas, 1874-1936," Ann Arbor: Inter-University Consortium for Political and Social Research, 1978.

Poor, Henry Varnum, Manual of Railroads. New York: Poor's Railroad Manual Co., various dates.

Simon, Matthew, "The Pattern of New British Portfolio Foreign Investment, 1865-1914, in J. H. Adler (ed.), Capital Movements and Economic Development. London: Macmillan, 1967.