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Technology's Retreat: The Decline of Rural Telephony in The United States, 1920–1940

CLAUDE S. FISCHER

ONE MILLION FEWER American farms had telephones in 1940 than in 1920; the instrument was disconnected in at least a third of the farm homes that once had it. Knowing how and why this “devolution” (Mattingly and Aspbury, 1985) occurred can expand our understanding of the social role of technology, diffusion of innovation, and more generally, twentieth-century modernization in America.

Although rural telephony was to recover later, thanks to an

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economic boom and government assistance, the widespread abandonment of the technology poses a puzzle. Farmers, at least outside the South, had welcomed the telephone enthusiastically and claimed that it played a central role in farm life (see Fischer, 1987). Falling farm prices in the 1920s and 1930s help but do not suffice to explain the relinquishing of the telephone. This "retreat" thus raises questions about theoretical views of material modernization: whether it is unilinear, cumulative, hegemonic, and irreversible.

After briefly describing the history of rural telephony, this paper examines the plausibility of various explanations for the decline, using four kinds of evidence: contemporary observations and data, a statistical analysis of farm telephone diffusion across the states, and more briefly, comparisons with other technologies and comparisons with telephone development elsewhere. These data point to competing technologies and corporate marketing strategies, within the contexts of financial stringency and of lack of government involvement, as the key factors in the "retreat."

The case depicts a more complex and disaggregated pattern of technological development than many theorists of technology and society have typically assumed (see Winner, 1977; Fischer, 1985). In the first place, diffusion results not from the immanent properties of the tool (a "technocratic" view) or from corporate manipulation (a "mass society" view); it is produced by an interplay of consumer autonomy, corporate strategy, and political economy. Second, modern technologies may undercut rather than propel one another. And third, different aspects of modernization, even of technological modernization alone, need to be "unpacked" from global models.

THE TELEPHONE IN RURAL AMERICA¹

From about 1880 to 1893, when the telephone was a patent-protected monopoly of the Bell System, few farms had it. Within seven years of the patents' expiration, literally thousands of independent telephone enterprises sprang up, most in rural areas and most as cooperatives by farmers themselves. These farm systems were technically crude, typically enrolled less than 50 subscribers, and were run informally. They purchased connections to town

Table 1 Percentage of American farms having telephones and other technologies, 1920, 1930, and 1940

	1920	1930	1940
Telephones*	39%	34%	25%
Automobiles	31	58	58
Indoor Water	10	16	—
Indoor Electricity	7	13	33
Radio	0	30	61

Source: USBOC (1952; 1975: 469, 487)

*Estimates by Builta (1930) and I. T. I. (1945) are that the 1925 rate for telephones was 41% and the 1935 rate was 21%.

exchanges from larger commercial companies. By 1920, almost 2.5 million farms had telephones (see U.S. Bureau of Census [USBOC], 1906; 1910, esp. 11-16; 1942). Most striking, by 1920, American farm households were more likely to have telephones than were town and city homes: 39% versus about 34%.²

For the most part, rural telephony was a consumer-driven diffusion, perhaps even a social movement (see, e.g., Atwood, 1984: 400). Farm families were enthusiastic about the telephone. They, as well as telephone salesmen and "country life" experts (e.g., Card, 1912), claimed that it saved lives, time and money and fostered social ties among isolated rural residents.

The rapid diffusion then reversed. Table 1 shows the percentage of farms with telephones by year, alongside the percentages of farms with other technologies. Telephone subscription dropped from 39% in 1920 to 34% in 1930 and to 25% of all farms in 1940. This 25% compares to the roughly 39% of *nonfarm* households that had telephones in 1940. Although there were great regional variations in rural telephone diffusion, this rise and fall was roughly parallel throughout the country. And, although industry representatives occasionally challenged the statistics, the precipitous drop was clearly not an artifact. Indeed, the drop is probably understated.³

What is striking in Table 1, of course, is not only the decline in farm telephony, but also its contrast with the patterns of rural diffusion for other—often far more expensive—technologies from 1920 to 1940.

Explanations

The rare observers who noted the decline favored a few basic explanations. Some claimed that farmers' *demand* for telephones dropped—because their incomes dropped (e.g., Mason, 1945: 90–92; Mathias, 1934), because telephone rates increased (e.g., U.S.F.C.C., 1944), because farmers chose alternative technologies (e.g., Blalock, 1940; Davidson, 1938), or because farming changed (e.g., Tomblein, 1931; U.S. House, 1949; Hadwinger and Cochran, 1984). Others claimed that the *supply* shrank—because farmers' mutual systems collapsed (e.g., Shenk, 1944; Blalock, 1940: 466; Fullarton and Goss, 1979), or because the major providers lost interest in farm customers (e.g., U.S.F.C.C., 1944; California P.U.C., 1960).

There is no need, of course, to select only one of these explanations. The Institute of Independent Telephony (I.T.I., 1945) argued, for example, that financial difficulties following World War I led farmers to disconnect their telephones; that once prosperity returned after 1935, farmers did not reconnect because there were now "too many other avenues of contact with the outside world" (p. 20) to justify paying for their typically inferior telephone service; and it correctly predicted that after World War II farmers would be affluent enough to purchase modern service.

The Issues

Although the greatest decline occurred during the 1930s, more intriguing are the 1920s, when a decline in subscription from 39% to 34% accompanied major increases both in farmers' ownership of other modern goods and in urban telephony. Why did so many American farmers end their subscriptions? Did farmers desire it less; if so, why? If not, why didn't entrepreneurs satisfy the demand?

CONTEMPORARY OBSERVATIONS

This section draws on contemporary evidence that speaks to the various explanations offered for the decline.

Were Farmers Too Poor to Afford the Telephone?

Did farmers, following the agricultural depression of the 1920s, become too poor for telephones?⁴ In affirmation: Well-off farmers were much more likely to subscribe than were poor ones (e.g., Kyrk et al, 1941a: 41–60), and farmers were said to be especially sensitive to rate increases (Builta, 1930; Spasoff and Beardsley, 1930; *Ohio Farmer*, 1927). Also, the timing fits: Farmers were relatively affluent in the 1910s when telephony boomed, but struggled through much of the 1920s and 1930s (see, e.g., Sage, 1983; Alston, 1983; Wolman, 1929: 70–76).

Yet, poverty seems to be an insufficient, or at best only partial, explanation for the decline. First, farm income regained or exceeded its level of 1921–23 in the late 1930s (U.S.B.O.C., 1975: 483); yet, telephone subscription recovered little. Second, American farmers obviously afforded many other things during this era. Table 1 shows how rapidly farmers bought automobiles, electric appliances, and the like. Local studies in the 1930s showed that farmers without telephones often did have gas service, washing machines, and other expensive technologies.⁵ Third, the objective cost of telephones—say, \$18 to \$24 a year—was not high. In the late 1920s, basic rural telephone service cost, nationwide, roughly 2.0% to 2.5% of average farm-generated income (perhaps 1.5% of average total farm family income); in the pit of the Depression telephone rates were about 5% (3%); and in the mid-1930s, 3% (2%).⁶ Even these costs are overestimates, because it was largely well-off farmers who were ever subscribers. Household budget surveys done in the mid-1930s show that telephone outlays were a small portion of expenditures, perhaps 5% to 10% of that for family automobile use.⁷

In sum, while many farmers could not afford telephones and most never had them even in 1920, it is hard to attribute the twenty-year decline in telephones simply to a decline in farmers' abilities to pay.

Did telephone rates increase? It is difficult to say, because no systematic data exist⁸ and the extant evidence is conflicting. Most likely, the "real" cost of telephone service *did* increase during the 1920s.⁹

Even so, cost increases alone could not, given the low rates farmers paid, account for such a precipitous drop. Cost could

have been important, however, in two, more complex, ways: One, increasing real costs could have led enough farmers to drop service to cripple the small rural companies, preventing them from serving other farmers. Two, constant or rising rates may have created a sense that the telephone was too costly for what it delivered in comparison to the new goods—radio, automobiles, movies, electricity—on the market.

Did Farmers Substitute Other Technologies for the Telephone?

In later years, telephone industry spokesmen said that farmers did not want the telephone or did not want it any more. They claimed that farmers had found other technologies, such as the automobile and radio, to be more satisfying substitutes.¹⁰ One independent telephone executive put it this way:

To the snowbound or mud-bound farmer of 1920, the telephone was the only readily available link to the outside world. It brought him news, weather information, social contacts generally, and . . . the cooperation of his neighbors . . . [S]ince then, with our great highway system and distribution of automobiles, and rural electrification with its radios and other appliances . . . [the telephone] did not, admittedly, have the same indispensable quality which it had prior to 1920. . . . [W]hen the depression commenced to lift for the farmer—about 1936— . . . the farm telephone found itself in competition for the farmer's dollar with a whole host of modern farm improvements. . . . [O]ld reliable farm telephone service had to take a back seat, temporarily, in the farm families' affections. [Mason, 1945: 86–88; for similar claims, see also U.S.B.O.C., 1942: 454; I.T.I., 1945: 21–22; Blalock, 1940: 467; Davidson, 1938; Tomblein, 1931; Holland, 1938; Pool, 1983: 52; *Telephony*, 1938].

Outside observers made similar statements (Allred et al., 1937: 5; U.S.F.C.C., 1944: 18–23). Some data suggest that farmers were not only less likely to have telephones as the period progressed, they were also less likely to *use* the telephones they did have.¹¹

Proving such substitution of technologies is difficult. But the timing, as shown in Table I, fits. On the other hand, why did such substitutions apparently not occur off the farm? *Nonfarm* tele-

phones per capita almost doubled during these 20 years, while nonfarm automobiles per capita almost tripled. Why did not urbanites also substitute new means for the telephone?

Did Small Rural Companies Collapse and Abandon Farmers?

Many of the small companies and cooperatives that served most farmers were poorly capitalized and built; charged low rates, yet still had problems getting increases and getting paid; did not set aside funds for depreciation and repair; could not obtain credit; often depended on voluntary labor that was not forthcoming; and were poorly managed (see, e.g., Shenk, 1944; Robertson and Amstutz, 1949; Parker, 1938; and Schmitt, 1951).

Several changes, it is argued, finally undercut these companies in the 1920s and 1930s: aging of equipment; new technical demands, such as rewiring to avoid interference from electrical power lines; and a worsening farm economy which led some members to drop out and others to resist paying. Deteriorating service led to disconnections and more resistance to rate increases, which furthered deterioration. Many farmers who held on were cut off when companies suspended neighborhood lines or closed down (see, e.g., Robertson and Amstutz, 1949; U.S. House, 1949; Acme, n.d.; Daubendiek, c. 1946; Clement, 1977; Nagel and Nagel, n.d.; Allred et al., 1937; Shenk, 1944; People's Mutual, 1976; Davidson, 1938).

Certainly, many rural providers were in bad shape. One post-World War II study in Indiana found that mutual companies' lines were out of order on an average of 13 days a year, and in some cases for weeks. Poor sound quality was also common (Robertson and Amstutz, 1949: 13-15; see citations above).

However, such complaints were typical in the telephone literature from the turn of the century onward (*Telephony: passim*). Why would these difficulties finally undermine rural telephony only in the 1920s? Furthermore, the decline in rural subscribers, at least during the 1930s, occurred in Bell territory to almost as great an extent as in non-Bell areas, a 31% versus 38% drop (AT&T, 1932; 1940: 6; 1941; in the 1920s Bell also lost subscribers in its small exchanges—Tomblein, 1931¹²). Furthermore, aggregate figures do not show a major decline in the number of small companies. Such companies actually became more numerous in

the mid-1920s, even while losing customers.¹³ They were thinned out in the Depression, by 11% between 1922 and 1937, but this is not commensurate with the 43% reduction in subscribers. (And some loss of lines resulted, not from collapse, but from consolidation [U.S.D.A., 1938; U.S.F.C.C., 1944: 27].)¹⁴

Even for those small lines that failed, there is little direct evidence that the cause was an internal collapse, rather than simply a loss of customers.¹⁵

Finally, an explanation based on structural failures of rural providers begs other questions: Why did rural systems have such difficulty raising capital? They had obviously raised funds at one time, and the costs do not seem to have been excessive.¹⁶ Why did not more new companies step in to serve farmers, as occurred in a few instances (People's Mutual, 1976; Farrell, 1955)? And, why did the Bell System also lose many farm customers?

Small rural operations were marginal and often provided poor service, driving some customers away and abandoning others. But this was not new. When farmers no longer could, or no longer cared enough to, support the system, or when no other vendors stepped forward, then the inadequacies of the rural companies meant a loss of subscribers.

Did the Big Companies "Freeze Out" Farmers?

In 1944, staff of the Federal Communications Commission decisively blamed the Bell System and large independents for the decline in rural telephony (U.S.F.C.C., 1944). They claimed that, between 1925 and 1934, Bell helped the independents raise their rates so as to shield its own high charges (see also U.S.D.A., 1938; Spasoff and Beardsley, 1930: 16ff). Critics also charged that the big companies were simply uninterested in serving farmers. One California farm leader claimed that the larger companies "froze out" small rural mutuals, let service deteriorate, and ignored farmer demand.¹⁷

There is little direct evidence for these contentions (although see U.S.F.C.C. [1938; 1939], Danielian [1939], and Page [1941] on industry "collusion"). The telephone industry's history in rural America does, however, lend them credence. Most of the time, Bell and other large companies provided minimal service to farmers, and that at high cost and sometimes under political

duress. Their representatives often expressed irritation with farmers, and farmers often pushed for government ownership.

Between roughly 1900 and 1915, however, telephone salesmen seriously pursued farm customers, apparently as a byproduct of competition for town customers. (From about 1900 to about World War I, competition between two or more telephone companies for customers in the same community was common.) They frequently signed up farmers at low rates in order to persuade residents of nearby towns, notably the merchants, to subscribe to their companies (e.g., Bush, 1908). Similarly, local managers often connected farmer lines to their town switchboards in order to deprive the competition of customers (see, e.g., Gary, 1928).

Then, from about 1913 to 1922, agreements midwived by the Federal government ended local telephone competition. Local monopolies were established and industry fraternity prevailed (see, e.g., Gary, 1928). In contrast to the late 1900s, neither Bell nor the independents seemed to have mounted rural sales campaigns in the 1920s. Indeed, industry sales people complained that aggressive efforts were not being made to sell to farmers (e.g., Burfeind, 1931; Sullivan, 1931; I.T.I., 1945: 20–21). The soliciting of rural customers resurged during the Depression as companies tried to stem disconnections and again more strongly in the 1940s when the threat of Federal loan subsidies for telephone cooperatives emerged.

Perhaps once past the 1905–15 period when farmers were “loss leaders” for town sales efforts, the large companies increased (real) farm rates or simply let rural service slide, or both.¹⁸

The industry rebutted this argument: There was no industry collusion; rates increased long before the decline in telephones; rates were relatively low (equivalent to one or two gallons of gasoline a week); the companies really tried to solicit farmers; the farm depression and the breakdown of the mutuals account for the decline; and farmers did not really want the telephone any more anyway (see, e.g., California P.U.C., 1960).

Summary

According to the archival evidence—the best data we have—straightforward economic explanations will not suffice. Neither poverty nor telephone rates alone can account for farmers’ dis-

connections between 1920 and 1930, certainly not when farmers bought so many other more costly goods. Nor is the chronic weakness of the farmers' lines a sufficient explanation. The conditions that precipitated the decline—and that may perhaps have made the farmers' financial distress, the cost, and the service problems significant rationales for disconnection—seem to be the increased availability of alternative technologies (both as direct substitutes and as more attractive investments) and the orientations of Bell and the large independents toward farmers.

A STATE-LEVEL STATISTICAL ANALYSIS

Further evidence is provided by statistics on farm telephones in the 48 states. What attributes of states and their farmers correlate with changes in telephone subscription over the two decades? This analysis assumes no serious aggregation effects, no ecological fallacy in reasoning back from states to farms; it necessarily relies on measures that are neither complete nor completely accurate; and, as with other small ecological data sets, it is vulnerable to multicollinearity and interdependencies. For reasons such as these, the statistical analysis can be only a supplement to other evidence. Nevertheless, it can reveal some systematic patterns in the telephone "devolution."

Data

The data come largely from U.S. agricultural censuses (U.S.B.O.C., 1952; 1975) and include: the number of farms in each state reporting telephones, automobiles, and other facilities, and the social and economic characteristics of the farms such as ownership, race of operator, and average value. Some supplementary data on the telephone industry and roads come from other governmental sources, particularly the *Censuses of Electrical Industries* (taken every five years from 1902 to 1937, U.S.B.O.C., 1905–39).

Variables

The key dependent variables in the models are the logged *number* of farms in a state reporting telephones, for 1920, 1930, and 1940.

(On errors in the data, see I.T.I., 1945; A.T.&T., 1941a,b.) I examined sets of related indicators in regression models predicting logged farms with telephones. The demographic domain included total farms, farm population, farm operators, farms operated by owners, and farms operated by non-owners (over 98% of whom were tenant farmers). I tested several measures of states' telephone industries but used most often the percentage of exchanges outside the Bell System. This measure is highly correlated with the logged number of non-Bell exchanges, but is not so collinear with other variables in the models as are alternative measures. Other variables are self-explanatory.

Method and Procedure

I tested model "robustness" in a few ways: running weighted regressions; examining regional effects; inspecting residuals (see Cook and Weisberg, 1982; Draper and Smith, 1981) and correcting for "influential cases" where necessary; running split-sample replications (in a sort of quasi-jackknife procedure); and testing for spatial autocorrelation.¹⁹ The substantive interpretations presented here are based on the most robust estimates. Other problems may be less tractable. In particular, we lack useful measures of telephone costs, and other variables may be inadequately measured. (The SYSTAT analysis package was used for most of the analysis [Wilkenson, 1985].)

I estimated *cross-sectional* models of farm telephony for each decennial year, by, first, establishing a "basic" model in which the logged number of farm telephones was correlated with demographic factors and then testing the partial associations of various other indicators of interest, notably measures of the telephone industry and of automobility. Second, I used the "best" cross-sectional model—defined by statistical criteria, robustness, interpretability, and substantive interest—to set up a dynamic analysis. The latter regresses the time-2 (T_2) dependent variable, logged number of farms with telephones, on its time-1 (T_1) values and on both the T_1 and T_2 values of the independent variables, X_i . The regression coefficients for X_{iT2} are estimates of how much farm telephony changes for each unit change in X_i (see Kessler and Greenberg, 1981).

Table 2 Cross-sectional models estimating (logged) number of farms with telephones, 1920, 1930, and 1940 (sample = 48 states; estimates are regression coefficients)

Variables (logged)	Mean	S.D.	1920			1930			1940		
			M=10.8		SD=1.36	M=10.05		SD=1.29	M=9.74		SD=1.23
			1.	2.		1.	2.		1.	2.	
Constant	—	—	-4.13**	-1.16		-5.42**	-3.35**		-6.66**	-3.69*	
Number of Farms, Owner-Occupied											
'20	10.92	1.06	.90**	.67**							
'30	10.84	1.04				.96**	.72**				
'40	10.87	1.05							1.01**	.62**	
Number of Farms, Not Own-Occup.											
'20	9.99	1.61	.43**	.46**							
'30	9.96	1.77				.34**	.26**				
'40	9.98	1.59							.30**	.28**	
Number of Farms, Non-White Oper.											
'20	7.37	2.56	-.22**	-.19**							
'30	7.37	2.61				-.23**	-.17**				
'40	7.28	2.57							-.27**	-.18**	
Average value of Land & Buildings (log dollars)											
'20	9.08	.69	.32**	.06							
'30	8.91	.66				.50**	.34**		.61**	.33**	
'40	8.58	.59									
Land (log sq. miles)	10.65	1.10	-.11	-.15*		-.10	-.19**		-.08	-.13*	
Deep South ¹	.15	.36		8.20**			4.73*			-.83**	

Percent Non-Bell Exchanges	'17	.59	.25	.43+			
	'27	.58	.24		.39		
	'37	.51	.24				-.13
Number of Farms with Automobiles	'20	10.05	1.21	.17			
	'30	10.75	1.17		.29		
	'40	10.73	1.14				.37+
Deep South X	'20	1.19	2.92	-1.08*			
Avg. Value	'30	1.15	2.82		-.68*		
States: ²	Nevada	.02	.14	-.87**	1.00**		.52+
	Arkansas	.02	.14				-.37+
	Massachusetts	.02	.14				.58*
	Minnesota	.02	.14				.47
R-squared			.948	.981	.977	.927	.976
(R-squared with number of farms only)			(.741)			(.519)	
Adjusted R-squared			.942	.974	.971	.917	.968

1. North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana.

2. Specific states included not (only) because they are significant, but because they influence parameters.

+p < .10; *p < .05; **p < .001

Results

Table 2 presents the results for three cross-sectional regressions of the logged number of farms with telephones on various predictors.²⁰ I focus on 1920, when states varied greatly in the number and proportion of farms reporting telephones (from 6% of farms in South Carolina to 86% in Iowa). The first equation might be termed the “basic” socioeconomic model. Further exploration of this model yields the equation 2 as the “best” description for 1920. Robustness tests suggest that some of the estimates are more stable than others, and I interpret the model as follows:

Other variables in equation 2 held constant, states high in farm telephones tended to have many owner-occupied farms and many tenant-occupied farms (the difference in parameters is not stable) but relatively few farms operated by non-whites. These states were not especially likely to have wealthy farms, once location in the “deep South” and the interaction of farm wealth and deep South location are statistically taken into account (for states in the deep South, $b = [0.06 - 1.08] = -1.02$). Those deep Southern states were especially low on telephones, compared to otherwise equivalent Northern states (cf. Liparito, 1985). States with a low density of farms (given other variables in the model—states such as Colorado, Texas, and Arizona) tended to have *fewer* farm telephones.²¹ Both the effects of non-Bell exchanges and of farms with automobiles are unstable, but the former implies, at least, that states with relatively high proportions of independent exchanges averaged about as many telephones as did those with relatively more Bell exchanges, all else equal, and the latter implies an independent *positive* association, across states, of automobile and telephony. (Nevada is included as a dummy variable because it is an extreme outlier and alters the coefficient estimates for non-Bell exchanges.)

Given the stability across the two decades (r for logged telephones, T_1 by $T_2 = .96, .97$), the 1930 and 1940 models are much like those of 1920, with several interesting changes. There was an increase during the period in the association of farm telephony with farm ownership—consistent with simple tables showing a greater drop in telephones for tenants than farm-owners—and with farm wealth, and an elimination of any advantage to states with non-Bell systems. (Among the other predictors tried but found insignificant was state urbanization.)²²

Table 3 Panel models estimating changes in (logged) number of farms with telephones, 1920-1930 and 1930-1940

Variables (counts are logged) (see Table 2 for means, SD's)		1920-1930		1930-1940	
		1.	2.	1.	2.
Constant		-1.66**	-1.96**	-2.25**	-1.96**
Nmbr. Farms with Telephone	T-1	.89**	.91**	.80**	.90**
Nmbr. Farms, Owner-Occupied,	T-1	-.34*	-.37*	-.43*	-.13
	T-2	.41**	.64**	.66**	.43**
Avg Value Land & Buildings,	T-1	.01	.20**	.33*	.15
	T-2	.21*	.05	-.03	.14
Land Area				-.12**	-.10**
Deep South		-.26**	-.24**	-.13+	
Percent Non-Bell Exchanges	T-1		-.45*		
	T-2		.35*		
Nmbr. Farms with Autos	T-1		-.00		.01
	T-2		-.22*		-.19+
Specific States:	Arkansas		-.35**		-.31**
	New Mexico		-.28**		
	Alabama				-.32**
	Minnesota				.33**
	Rhode Island				-.31**
R-squared		.994	.998	.993	.996
Adjusted R-squared		.993	.997	.992	.995
R-squared for Tel T ₁ + nmbr. farms, T ₁ & T ₂		.986		.985	

+p < .10; *p < .05; **p < .001

Table 3 presents the heart of the statistical analysis: panel models of the change in farm telephones over each of the two decades. Nationally, farm telephones declined 14% during the 1920s, but in some states it dropped more than 50% (Arkansas, Georgia, and Alabama) and in others it increased more than 25% (California, Nevada, and Arizona). The "basic" equation 1 for 1920-1930 shows, first, that number of farms with telephones in

1930 correlated highly with that number in 1920. Relative change correlated independently with changes in the number of farms occupied by owners but not those occupied by tenants or by non-whites. States whose farms became more valuable did best. States in the deep South were especially likely to fall behind otherwise comparable states. The full 1920–30 model, equation 2, sustains these conclusions, although the coefficients for 1920 and 1930 average farm value are unstable.²³ Suffice it to say that states with affluent farms or those with farms that became relatively more affluent sustained telephony. In addition, increases or minor declines in non-Bell exchanges were *positively* associated with changes in farm telephony. These parameters are also unstable (excluding New England states cancels the coefficients for non-Bell exchanges), but one cannot claim—as the “collapse” thesis suggests—that non-Bell states were, *ceteris paribus*, disadvantaged. Finally, states with the greatest relative increases in farm automobiles tended to have the greatest *declines* in farm telephony.²⁴ These factors explain 86% of the variance in farm telephony that cannot be explained simply by the states’ positions in 1920 and changes in the number of farms (0.998 minus 0.986).

In the 1930s, farms with telephones declined nationally by 29%, in some states by 45% or more (Alabama, Arkansas, and Mississippi) but increased in a few others (Massachusetts, Maryland, and Connecticut). As before, changes in telephone diffusion correlated with changes in farm ownership—not tenancy—and in farm affluence. (Although the coefficients for average farm value are nonsignificant, they are both positive and jointly influence the model in major ways.) The deep Southern states followed national trends, but the sparsely-settled states (relative to the model, such as Nevada, Texas, Idaho, and Wyoming) fell further behind the others. Bell- and independent-dominated states did not differ from one another in patterns of change. And, again, increases in farm automobility typified states with more rapid declines in farm telephony.²⁵

A simple gloss on these results is that, from 1920 to 1940, states’ farm telephony became increasingly stratified by their tenancy, wealth, and settlement density, in addition to persisting stratification by region and racial composition. States marked by farm tenancy, poverty, and sparsity, tended, all else equal, to lose more farm telephones. In addition, those states most rapidly gain-

ing farm automobiles appear to have lost more farm telephones than did otherwise comparable states. Finally, the independent-dominated states were not disadvantaged, and probably were advantaged, relative to Bell-dominated states in sustaining farm telephony, all else equal.

Implications

These results raise anew the role of income (and/or cost). Average farm value became increasingly important in distinguishing states with many farm telephones from those with few, albeit not so important as other factors. The results also implicate the organization of farming in suggesting that tenant farmers were decreasingly able to sustain farm telephony (a distinction, by the way, that did not affect the diffusion of farm automobiles). Finally, they also modestly support the claim that the automobile reduced the demand for telephones.

On the supply side, the results cast doubt on explanations that point to a collapse of the independent companies; Bell seems more associated with the decline. The results also implicate the industry's policy-makers, albeit indirectly: Certain features of the poorly-telephoned states—non-white farmers, tenant farming, location in the deep South, and perhaps farm poverty—may determine aggregate individual demand (i.e., such farmers could not or did not want to pay for telephones), or alternatively, they may reflect *marketing decisions* not to pursue customers in certain locations or of certain types (cf. Liparito, 1985). It is clear, for example, that Bell and other companies simply did not consider blacks to be a market. Finally, the results suggest that states where farmers were dispersed were especially vulnerable to losses in telephony. (Farmers in these states, such as North Dakota and Oklahoma, may have always had technically and financially marginal telephone systems; but they did relatively well in acquiring automobiles.)

COMPARISONS ACROSS TECHNOLOGIES

Yet another approach, one that provides a wider context, is to contrast the history of rural telephony to that of other rural technologies. Space permits only a brief glance at the case of rural

electrification, the history of which has significant parallels to that of telephony,²⁶ and to rural automobility.²⁷

Electrification advanced modestly in the 1920s and then rapidly during the Depression, in large part directly and indirectly because of government intervention. Rural automobile diffusion was rapid in the 1920s, an era of falling car prices (especially of used cars), and then held constant in the Depression (see Table 1). Both technologies, although quite different in structure and sales, share a feature in common: their treatment as public goods, subsidized by taxes.

Rural electrification advanced, in part, through the Tennessee Valley Authority, the Rural Electrification Administration, and the competition they presented to private power companies. There are also "public goods" aspects to automobility: roads, traffic control, safety systems, and the like. Although user taxes paid for much of automobile infrastructure, much was also provided by local property taxes and by state and federal taxes. By 1929, one-fifth of all government outlays went to highways (Woody, 1933: 1325-1327). And almost all support was funnelled through government, even quite indirectly: for example, the Post Office required improved roads for Rural Free Delivery (Fuller, 1964: 182ff).

While telephone users may have been benefited from government-required cross-subsidization of residential and of rural service, that assistance was certainly not sizeable until after World War II. By and large, telephone subscribers had to capitalize, individually or as a locality, the estimated costs of telephone infrastructure.

In further statistical work (not shown here to save space), I adapted the models of farm telephony to analyze changes in state levels of farm electrification and automobility. The results point to a few distinctive features of telephony: Only shifts in telephones were responsive to location in the deep South and to the number of non-white farm operators, and, in the 1920s, to levels of farm wealth. (In the 1930s, all three technologies fluctuated with farm value.) These distinctions point again to something about the marketing and pricing of the telephones. And, only telephony was associated negatively with the diffusion of another technology (more automobiles at time 1, fewer telephones ten years later).

The latter suggests a special weakness in the demand for telephones, in that only telephony gave way to modal competition.

COMPARISONS ACROSS COUNTRIES

The wider political and economic contexts of rural telephony are perhaps best highlighted by cross-national comparisons. By 1920 in continental Europe all the systems were government monopolies, or, particularly in Scandinavia, a combination of rural co-operatives and national monopoly.

Telephone service grew slowly in most European countries, but the authorities attended to rural villages, at least by placing long distance connections in local post offices (as a supplement or replacement for telegraphic service) and by adjusting rates to satisfy small users. Nevertheless, rural exchanges that connected local farmers to one another were rare and small in most of Europe, for several reasons, including, no doubt, desperate poverty. One exception is Scandinavia, which shared the same kind of dispersed farmsteads, culture, and grassroots telephony as the American Midwest (see Holcombe, 1911).

Between 1920 and 1940, and especially during the Depression, rural telephony apparently increased, in some cases sharply, in Europe.²⁸ Government ownership is probably the key to both differences between the United States and Europe: American competition before World War I stimulated rural telephony far beyond that of Europe. Then, in the Depression, European governments were able to sustain telephone expansion in rural areas in ways private vendors in United States could not (see, e.g., Berthot, 1981). It is also likely that, since motorization did not spread as rapidly in Europe, it did not undercut telephone development.

Canada

The Canadian case is more complex. Some provinces were dominated by Bell, while the Prairie provinces were under government monopolies, and both forms often combined with rural cooperatives. Canada had neither the same level of competition nor of farm cooperatives as did the United States, especially the Mid-

west. Perhaps for that reason, farmers had proportionately fewer telephones at the end of World War I than did city residents (possibly half the rate; Pike and Mosco, 1986). On the other hand, Bell, which held the central agricultural regions, came under firmer regulatory control sooner in Canada, a development which should have encouraged farm service.

Rural subscription grew in most Canadian systems until the Depression, with the notable exception of Saskatchewan, where farm telephony dropped sharply in the 1920s.²⁹ The government systems of Manitoba and Alberta, which explicitly used cross-subsidies and tax funds to aid rural service, sustained rural telephony until the Depression.

During the Depression, all the systems suffered losses of rural subscribers—about 25% by circa 1934—and then recovered to 1924 levels by 1940. (Note that the losses were not so great as in the United States.) Although the agricultural depression of the late 1920s was critical, financial conditions alone do not explain the Canadian losses. While telephone users dropped from 43% to 26% in the Prairie provinces between 1926 and 1931, automobile ownership rates went up from 41% to 46% and tractor ownership from 20% to 28%. Commentators on Canadian telephony point to the marginality of the rural systems, more sparsely settled than the United States, as another cause, and to substitution effects—for example:

The installers who travelled the countryside removing phones for nonpayment reported a general feeling. Though the telephone had once ended the isolation of the farm, radio and better roads were now doing it, and if farmers had the cash they'd rather buy gas than rent a telephone (Cashman, 1972: 362).³⁰

SUMMARY AND CONCLUSION

Why *did* so many American farmers abandon telephones between 1920 and 1940? It is neither conceptually nor empirically possible to determine *an* explanation for a particular historical event. And, certainly, further evidence could be amassed.³¹ But we have narrowed the possible explanations.

Declining farm income and increasing or static telephone costs

do not *in themselves* seem to be key, particularly for losses of the 1920s. They were probably important, however, in forcing farmers to choose among expenditures—leaving open the question of why they chose to spend as they did.

The other major industry explanation, that the small farmer lines died of their lingering illnesses, is also insufficient. To be sure, these lines often provided marginal service. But the companies did not really collapse; they shrank. And they shrank probably because of external factors rather than from irreversible internal difficulties. Given sufficient interest in telephony, the latter problems could have been solved by infusions of capital. And we should recall that Bell companies also lost many rural subscribers.

Among the circumstances that conjoined to undercut rural telephony, two stand out: One is the changing technological environment of automobiles, surfaced roads, radio, movies, and so on. Before World War I, farmers eagerly demanded the telephone and often provided it themselves. It eased the “country problem.” But they began buying other technologies in large quantities in the 1920s: automobiles, radios, electricity, plumbing. Some of these innovations offered partial alternatives to the telephone in providing communication, news, and entertainment. A few of these came with collective subsidies telephones did not have. All competed for the farmer’s spending. And perhaps, their success and efficiency sharpened dissatisfaction with rural telephone service. (Non-farmers, on the other hand, typically received better-quality telephone service and were probably not so pressed financially to make trade-offs.)

The second major structural circumstance is the political economy of service delivery. When the American telephone was a private monopoly, farmers were largely unserved. When competition was rife, they had more telephones than did urbanites, and at bargain prices (even if at bargain quality). When local monopoly was restored, farmers fell behind. (And when the Federal government intervened in the 1940s, the farmers began quickly catching up.) It would seem that the slackening of corporate interest in farmers—expressed in the abandonment of low rates, technical aid, aggressive marketing, and so on—undercut rural telephony. In addition, the farm systems, left dependent on local support

(unaided by government or national corporations), were especially vulnerable to losing their "critical mass" of users.

Beyond 1940

Returning economic fortunes at the end of the 1930s and in the War years supported a re-growth of rural telephony—more often, now, under the aegis of Bell and other large companies—but the 1920 level of 39% diffusion was not regained until about 1950. By then the Federal government had intervened, over the objections of the private industry, by placing rural telephone cooperatives within the R.E.A. structure of cheap loans and technical aid. Since then, rural telephony has approached—although not matched—the universality of urban service.

Wider Implications

First: Analysts of innovation diffusion have begun looking at how the traits of innovations shape their spread (e.g., Fliegel and Kivlin, 1966). This case points to a few attributes perhaps slighted in the literature (see Rogers, 1983: Ch. 6): substitutability and competition—the extent to which use of a new technology can be replaced by others, in this case by the automobile and radio³²—and perhaps more important, the extent to which a technology is a collective good. For rural Americans, sparsely settled and individualistic (U.S. Senate, 1909; Baker, 1985), the telephone was especially vulnerable as a collective good. In the farmer cooperative lines, failure to donate labor or capital undermined the service, and as people dropped off the system, it became less valuable to others. This problem applied much less to, say, automobiles or radios.

Second, this story underlines the role of entrepreneurs as diffusion agents (see L. A. Brown, 1981). The decisions of the Bell System and its major competitors, such as whether and where to build an exchange, how to attribute plant costs, how to regulate connections, and whether to mount sales efforts, shaped the course of rural telephony—not *instead* of consumer demand, certainly, but neither in simple response to consumer demand. Conversely, we see, by its *weakness* in the United States, the

important role of government in collectivizing the costs of innovation.

In the United States, telephone service has largely been treated as a private market good (regulated, to be sure, with varying degrees of stringency). Even in the United States, automobility and electrification received much greater collective aid than did telephones. In the era of widespread competition, the "free market" in telephones allowed American farmers to do exceedingly well. They were courted by telephone companies and were allowed to build their own lines, sometimes at substandard levels few central governments would permit. In the eras of private monopoly and oligopoly, however, they were largely ignored. Both the boom and bust of American farmers' telephones occurred within a relatively narrow political economic context.³³

More general still, this case of "devolution" reminds us that technological development is not linear, inevitable, nor immanent in the technology. "Retreats" occur. And it reminds us that modern technologies are not all of one kind, mere reflections of an underlying "rationalization" or "differentiation." They have their particular uses, roles in social action, and courses of development. Indeed, modern technologies may undercut one another. "Modernization" may be, at best, a loose collection of social and material changes that need to be "unpacked" (Fischer, 1985). Such unpacking might best be accomplished by close-grained empirical studies of how major modern technologies were diffused, adopted, and used.

NOTES

- 1 For general histories of the telephone in America, see Brooks (1976), Brock (1981), Danielian (1939), Garnet (1985), MacMeal (1934), and Pool (1977). References on rural telephone history are sparse. See Fischer (1987), the industry journal, *Telephony*, AT&T Historical Archives, R.E.A. (1974), Atwood (1984), Fullarton and Goss (1979), and Parker (1938), for example. Although I use the term "rural," the concern is largely with *farm* telephones. About 80% of rural telephones were on farms (I.T.I., 1945: 13; Mason, 1945: 86); thus only occasionally will this distinction matter. "Farm" typically requires, in the *Census*, at least three acres under agricultural production or \$250 a year of produce. A farm was counted as one with a telephone if one or more instruments was reported to be anywhere on it. Although some confusions may have been created by multi-dwelling and abandoned

farms, these were likely to be few. For the *industry*, on the other hand, "rural" telephones typically meant those outside any town exchange's basic rate area and thus included distant suburban homes, hamlet stores, and so on.

- 2 The 39% figure is from the Agricultural Census (U.S.B.O.C., 1952); the 34% figure is calculated using the farm numbers and the overall statistics on telephones in U.S.B.O.C. (1975: 783). There is barely a reference to the decline in rural telephony in the small secondary literature on the telephone (see, however, Independent Telephone Institute [I.T.I.], 1945; U.S. Federal Communications Commission, 1944; and Hadwinger and Cochran, 1984). Contemporary reports suggest that, at least until well into the Depression, industry observers did not notice the trend.
- 3 Understated because many companies kept non-paying customers on the books (e.g., Rakow, 1987: 138). See I.T.I. (1945), A.T.& T. (1941), Blalock (1940: 467), Mason (1945), Melvin (1931), Nagel and Nagel (n.d.), and West (1945: 32n), as well as the sources cited below.
- 4 Many commentators present this argument, including I.T.I. (1945), Hadwinger and Cochran (1984), Mason (1945: 90–92), People's Mutual (1976: 22), Pool (1983), and Mathias (1934).
- 5 A 1938 survey in rural Texas and Arkansas, for example, found that most farmers had gas, electricity, piped water, and automobiles, while less than a fifth had telephones (Blalock, 1940: 468–469; see also Kyrk et al, 1941a: 41; and Allred, et al., 1937: 5).
- 6 Rural telephone rates were estimated by U.S.D.A. (1938). Farm income is reported in U.S.B.O.C. (1975: 483). In the early years, only income based on sales of farm products was reported; data from later years suggest that those sales represented about 60% of total farm family income.
- 7 A 1920s survey of white farm families estimated a mean expenditure on telephone service for non-business use of \$4.40 a year versus \$79.70 for automobiles (Kirkpatrick, 1926). Farm families surveyed in Pennsylvania and Ohio in the late 1930s who had telephones spent an average of \$22 a year on them (\$18 base rate plus toll calls), compared to \$132 a year on family use of an automobile (\$80 for operating expenses alone), \$108 a year on clothes, and \$12 a year on tobacco (Kyrk et al, 1941a; Monroe et al, 1941a). A 1941 survey of farm families reports \$120 spent a year on non-business automobile use and \$20 on tobacco (U.S.B.L.S., 1945: 75). Other figures indicate that the *minimum* cost for electricity ran about \$23 a year (Brown, 1980: 70).
- 8 The only estimates, in USDA (1938), were based on a small fraction of states and an unknown number of companies in each which responded to a survey. On the cost issue, see, for example, Mulrooney (1937), Farrell (1955), Sichter (1977), U.S. Congressional Budget Office (1984: Appendix C), Brock (1981: 107), *Telephony* (1933), and Spasoff and Beardsley (1930).
- 9 They show an increase in charges farmers paid from the early 1910s to the early 1920s and then roughly no change. If so, the greatest increase in rates coincided with an *increase* in rural subscription, while price stability coincided with a *decrease* in subscriptions. This is the evidence that industry defenders pointed to for denying that their charges were responsible (e.g.,

- Mason, 1945: 89-90; I.T.I., 1945: 18). On the other hand, in the 1930s, telephone rates remained constant while most other products, including farm produce, declined in price. Thus, telephone rates *did* increase then in constant dollars or volume of farm product (Persons, 1945; Mason, 1945: 95; Mathias, 1934; Gray, 1924; U.S.D.A., 1938). Also, the price increases of the 1910s, conceded by the industry, may have had a lagged effect on disconnections. Farmers hit by economic losses in the 1920s might have been able to continue subscriptions had the rates of the early 1910s never been raised (point suggested by Ilan Solomon).
- 10 See, e.g., "Conference on Rural Service," in Cal. P.U.C. (1960); also Pacific Telephone and Telegraph (1945); testimony to U.S. Senate (1949); Blalock (1940: 467); *Telephony*, *passim*.
 - 11 Telephone companies earning under \$10,000 annual income—usually assumed to be overwhelmingly rural systems—reported a drop in originating calls per telephone per day: 3.7 in 1922 to 1.7 in 1937. By contrast, the daily averages for Bell System telephones—overwhelmingly urban—stayed constant or increased. (These figures were calculated from various tables in U.S.B.O.C. [1924, 1930, 1934, 1939]; see also, U.S.B.O.C. [1975: 783].) These estimates should be taken with some reserve but do support the contention that farmers lost interest in the telephone (as opposed to an alternative expectation that impoverished farmers would increasingly borrow one another's phones and thus raise the average use).
 - 12 Bell subscriptions were stagnant in rural states during the 1920s, a fact which implies, given continued urban growth, that Bell was probably losing farmers. Then, Bell clearly lost rural subscribers in the 1930s (see A.T. & T., 1932a,b; 1941a,b).
 - 13 The number of telephone systems and lines with annual earnings under \$10,000—usually taken to be roughly indicative of rural providers—was 56 thousand in 1922, up to 59 in 1927, down to 55 in 1932, and then down to 50 in 1937—with 2.1, 1.8, 1.1, and 1.2 million customers respectively. The 1922 figure is based on an estimate of 56,000 companies under \$10,000 in annual income (U.S.B.O.C., 1934: Table 6); the 1927 figure is the sum of all "connecting lines," 51,000, plus switching companies with under \$10,000 income, 8,000; the 1932 figure represents 38,100 connecting lines, 10,550 additional ones with fewer than five telephones, and 5,800 small switching companies; and the 1937 estimate combines 32,100 connecting lines, 11,800 with fewer than five instruments, and 5,800 switching companies (U.S.B.O.C., 1939: Tables 9, 11).
 - 14 These figures are, of course, not without ambiguity. Aside from inaccuracies in reporting, the stability in numbers may actually be due to larger companies dropping into the class of small companies because of difficulties.
 - 15 One fragment of supportive data, however, comes from an Indiana survey of non-subscribing farmers in 1948. Of 34 who had telephones at one time, 31 said that the service had been discontinued to them or that the service was so poor they dropped it (Robertson and Amstutz, 1949: 20, 31).
 - 16 E.g., a small Virginia cooperative established in 1920 charged \$50 per initial share and connection, exactly the same figure its local predecessor assessed in 1904 (People's Mutual, 1976). A study done in the 1920s suggests that the

difference in rates between small companies providing good service and those providing poor service was only about 10% (Spasoff and Beardsley, 1930: 18).

- 17 J. J. Deuel, Farm Bureau Federation, in "Conference on Rural Service Problems," 1944, in Cal. P.U.C. (1960).
- 18 E.g., in 1930, in U.S. counties where 85% or more of the telephones were Bell, only 24% of farms had telephones, compared to 38% of farms where 85% of the instruments were non-Bell and 40% for counties in between (A.T.& T., 1932b).
- 19 I tested for spatial autocorrelation by constructing a proximity matrix of states (where 3 = contiguous, 2 = same region, 1 = same division, and 0 = other) and applying the AUTCOR program to most of the equations in tables 2 and 3 (Reitz and Dow, 1985; see also Dow, 1984; Doreian, 1981). Fortunately, this made negligible differences.
- 20 Since we have a "universe," significance tests are just heuristic.
- 21 A perhaps better estimate of farm density than land area of the state is arable land area. I roughly estimated that variable (using maximum land under cultivation in 1920 or 1940) and found that it made little difference in table 2 except to reduce the idiosyncratic effect estimate of Nevada and increase the effect estimate for percent non-Bell exchanges.
- 22 If arable land area is used instead of total area, percent non-Bell exchanges stays significant for 1930.
- 23 The pair are significant, but whether it is T_1 or T_2 that has the significantly positive coefficient varies by robustness test.
- 24 Using an arable land measure instead of total land area, however, renders the effect not statistically significant, suggesting that it was in sparsely-settled states—such as Texas, Oklahoma, and upper Rocky Mountain states—that automobile ownership undercut telephone subscription.
- 25 Although the coefficients for farms with automobiles fluctuate and become nonsignificant if arable rather than total land is used, they generally show a negative effect for the change.
- 26 Basic sources on electrification are D. C. Brown (1980; 1982), Childs (1952), Cooke (1925), Coleman (1952), Ellis (1966), and McDonald (1957).
- 27 On the automobile in rural America, see, for example: Rae (1965, 1971), Flink (1970), Berger (1979), Interrante (1979), Moline (1971), and Wik (1972).
- 28 The data for these claims are drawn from the articles, "World's Telephone Statistics," appearing annually in the Bell Telephone Quarterly, usually in July, from 1922 to 1937. The data do not refer to rural telephony, per se, but do distinguish small versus large communities. In 1927, for example, the numbers of telephones per capita for places under 50,000 population was as follows: U.S., 11.9; Canada, 9.2; U.K., 1.8; France, 1.1; Germany, 2.4; Norway, 5.0; Denmark, 7.0; and Sweden, 5.4. In 1937, the numbers were: U.S., 10.3; Canada, 7.7; U.K., 4.0; France, 2.1; Germany, 3.1; Norway, 5.1; Denmark, 7.2; and Sweden, 8.1.
- 29 Saskatchewan had earliest and most aggressively encouraged cooperatives and had attained the highest level, by far, of rural telephone diffusion in the early 1920s.

- 30 The Canadian data are patchier and less precise than the U.S. data. See Canada (1925–1940); Urquhart and Buckley (1965: 351–354). For general descriptions of Canadian telephony, see Armstrong and Nelles (1986); Price and Mosco (1986); Patten (1926); Collins (1977); Cashman (1972); and Bell Canada Historical Archives, Montreal.
- 31 For example, the local archives of companies serving rural populations could be examined. Statistical analyses could be expanded forward and backward in time and downward in scale to counties or telephone exchanges. Parallel archival work could be done on electrification and automobile diffusion. And primary cross-national research could be carried out. In the interim, the materials presented here are the first serious compilation on this event.
- 32 Rogers (1983: 226–227) notes that technologies may spread faster if they come in a “cluster;” the reverse may also hold on occasion.
- 33 I am not simply saying here that government systems subsidize unprofitable uses. Whether rural telephony is, in fact, unprofitable, is unclear (U.S.C.B.O., 1984). More important, the issue is the perspective deliverers hold of infrastructure costs. At times Bell, for example, claimed that the telephone system was unitary and all users benefited from access to all other users. And they priced service accordingly, especially when they used farm service as a “loss leader.” (E.g., by one calculation, merchants’ rates subsidized farmers’ rates.) National governments, of course, see the return of a system this way, as collective good. It is another perspective—one Bell also adopted at times—to assign full infrastructure costs—and that, at rapid amortization—to the immediate users alone. Which one is “correct” I do not address; I merely point out that these are not givens, but choices.

REFERENCES

- Acme Mutual Telephone Association. (n.d.) “Acme Mutual Telephone Association 1905–1969.” Manuscript, Museum of Independent Telephony, Abilene, KA.
- Allred, C. E., T. L. Robinson, B. H. Luebke, and S. R. Nesraug (1937) *Rural Cooperative Telephones in Tennessee*. Rural Research Series Monograph No. 45. Knoxville: University of Tennessee Agricultural Experiment Station.
- Alston, L. J. (1983) “Farm foreclosures in the United States during the interwar period.” *Journal of Economic History* 43 (December): 885–903.
- American Telephone and Telegraph Company (A.T. & T.). (1932a) “Selected statistics relative to residence and farm markets,” Chief Statistician’s Division (November), mimeo courtesy of A.T. & T. Historical Archives, New York.
- (1932b) Untitled. Chief Statistician’s Division (July 27), mimeo courtesy of A.T. & T. Historical Archives, New York.
- (1940) “Families and residence telephones,” Chief Statistician’s Division (December 18), mimeo courtesy of A.T. & T. Historical Archives, New York.
- (1941a) “Rural population and telephones,” Chief Statistician’s Division (June 13), mimeo courtesy of A.T. & T. Historical Archives, New York.

- (1941b) "Final results of U.S. Census of Agriculture . . .," Chief Statistician's Division (September 25), mimeo courtesy of A.T.& T. Historical Archives, New York.
- (1947) Untitled letter to all comptrollers, Chief Statistician's Division (April 2), mimeo courtesy of A.T.& T. Historical Archives, New York.
- Armstrong, Christopher, and H. V. Nelles (1986) *Monopoly's Moment: The Organization and Regulation of Canadian Utilities, 1830-1930*. Philadelphia: Temple University Press.
- Atwood, R. A. (1984) "Telephony and its cultural meanings in southeastern Iowa, 1900-1917," Ph.D. Dissertation, University of Iowa.
- Baker, P. (1985) "The farmer as a social problem: Reform, professionalization, and the country life movement." Paper presented to the Organization of American Historians, Minneapolis, April.
- Berger, M. L. (1979) *The Devil Wagon in God's Country: The Automobile and Social Change in Rural America, 1883-1929*. Hamden, CT: Archon Books.
- Blalock, H. W. (1940) "Streamlining rural telephone service." *Public Utilities Fortnightly* 26 (10 October): 466-473.
- Brock, G. W. (1981) *Telecommunications Industry: The Dynamics of Market Structure*. Cambridge, MA: Harvard University Press.
- Brooks, J. (1976) *Telephone: The First Hundred Years*. New York: Harper and Row.
- Brown, D. C. (1980) *Electricity For Rural America: The Fight for the R. E. A.* Contributions in Economics and Economic History No. 29 Westport, CT: Greenwood Press.
- (1982) "North Carolina rural electrification: Precedent of the R. E. A." *North Carolina Historical Review* 59: 109-124.
- Brown, L. A. (1981) *Innovation Diffusion: A New Perspective*. New York: Methuen.
- Buila, F. C. (c. 1930) "How can publicity assist in meeting our responsibility to the rural telephone user?" in "Publicity Conferences: of the Bell System, 1921-1934," Box 1310: 73-82; A.T.& T. Historical Archives, New York.
- Burfiend, R. H. (1931) "Economics of rural exchanges." *Telephony* 101 (26 December): 36-37.
- Bush, G. B. (1908) Letter to E. C. Bradley, 21 November, in "Rural telephone service," Box 1363, A.T.& T. Historical Archives, New York.
- California Public Utilities Commission. (1960) Special Study No. 448: "Development of telephone service in rural areas, 1944-1960." Sacramento: State of California Archives.
- Canada (1922-1940) Dominion Bureau of Statistics. "Telephone Statistics for 19 . ." Ottawa: Department of Trade and Commerce.
- Card, F. W. (1912) "Cooperative fire insurance and telephone," *Cyclopedia of American Agriculture*, Volume IV, 4th Edition. New York: MacMillan, 303-306.
- Cashman, Tony. (1972) *Singing Wires: The Telephone in Alberta*. Edmonton: Alberta Government Telephone Commission.
- Childs, M. (1952) *The Farmer Takes a Hand: The Electric Power Revolution in Rural America*. Garden City, New York: Doubleday.

- Clement, E. A. (1977) *The North Carolina Telephone Story*. Raleigh: North Carolina Independent Telephone Association.
- Coleman, C. M. (1952) *P. G. and E. of California*. New York: McGraw-Hill.
- Collins, R. (1977) *A Voice from Afar: The History of Telecommunications in Canada*. Toronto: McGraw-Hill Ryerson.
- Cook, R. D., and S. Weisberg (1982) "Criticism and influence analysis in regression," in S. Leinhardt (ed.) *Sociological Methodology 1982*. San Francisco: Jossey-Bass: 313-361.
- Cooke, M. L. (1925) "A note on rates for rural electric service." *The Annals* 118 (March): 52-59.
- Danielian, N. R. (1939) *A T. & T.: The Story of Industrial Conquest*. New York: Vanguard.
- Daubendiek, C. H. (c. 1946) "Fifty-two years of progress in the independent telephone industry," Jefferson (IO) Telephone Company, photocopy at the Museum of Independent Telephony, Abilene, KA.
- Davidson, A. G. (1938) "Serving Rural Subscribers in Fringe and Suburban Areas." *Telephony* 115 (13 August): 11-13.
- Doreian, P. (1981) "Estimating linear models with spatially distributed data," in S. Leinhardt (ed.) *Sociological Methods 1981*. San Francisco: Jossey-Bass: 359-388.
- Dow, M. (1984) "A bi-parametric approach to autocorrelation." *Sociological Methods and Research* 13 (November): 201-217.
- Draper, N. R., and H. Smith (1981) *Applied Regression Analysis*, Second Ed. New York: Wiley.
- Ellis, C. T. (1966) *A Giant Step*. New York: Random House.
- Evans, H. (1925) "The world's experience with rural electrification." *The Annals* 118 (March): 30-42.
- Farrell, F. D. (1955) *Kansas Rural Institutions: IX. Rural Telephone Company. Agriculture Experiment Station Circular No. 326*. Manhattan, KA: Kansas State College of Agriculture.
- Federal Writers' Project. (1939) *These Are Our Lives*. Chapel Hill: University of North Carolina Press.
- Fischer, C. S. (1985) "Studying technology and social life," in M. Castells (Ed.), *High Technology, Space, and Society*. Beverly Hills, CA: Sage: 284-301.
- (1987) "The revolution in rural telephony." *Journal of Social History* (In Press).
- Fliegel, F. C., and J. E. Kivlin (1966) "Attributes of innovations as factors in diffusion." *American Journal of Sociology* 72 (November): 235-248.
- Flink, J. J. (1970) *American Adopts the Automobile, 1895-1910*. Cambridge, MA: M.I.T. Press.
- Fullarton, D. C., and F. D. Goss [eds.] (1979) *NTCA Our First 25 Years*. Washington: National Telephone Cooperative Association.
- Fuller, W. E. (1964) *R.F.D.: The Changing Face of Rural America*. Bloomington, IN: Indiana University Press.
- (1972) *The American Mail: Enlarger of Common Life*. Chicago: University of Chicago Press.
- Garnet, R. (1984) "The telephone enterprise: The evolution of the Bell system's

- horizontal structure, 1876-1909." Ph.D. Dissertation, Johns Hopkins University.
- Gary, T. (1928) "The independents and the industry." *Telephony* 90 (March 13): 14-18.
- Gray, W. F. (1924) "Typical schedules of rates for exchange service." In Bell System General Commercial Engineers' Conference, New York City. Microfilm 364B, Illinois Bell Historical, Chicago.
- Hadwinger, D. F., and C. Cochran. (1984) "Rural telephones in the United States." *Agricultural History* 58 (July): 221-238.
- Holland, J. D. (1938) "Telephone essential to progressive farm home," *Telephony* 114 (19 February): 17-20.
- Independent Telephone Association, Inc. (1945) "The farm telephone story." Chicago: I.T.I. (photocopy from Museum of Independent Telephony, Abilene, KA).
- Interrante, J. (1979) "You can't go to town in a bathtub: Automobile movement and the reorganization of rural American space, 1900-1930." *Radical History Review* 21 (Fall): 151-168.
- Kessler, R. C., and D. F. Greenberg (1981) *Linear Panel Analysis*. New York: Academic Press.
- Kyrk, H., D. Monroe, D. S. Brady, C. Rosenstiel, and E. D. Rainboth (1941a) *Family Expenditures For Housing and Household Operation. Five Regions. Consumer Purchases Study, Farm Series*. Bureau of Home Economics. Misc. Pub. No. 457. Washington, DC: U.S. Department of Agriculture.
- Kyrk, H., D. Monroe, K. Cronister, and M. Perry (1941b) *Family Expenditures For Housing and Household Operations. Five Regions. Consumer Purchase Study, Urban and Village Series*. Misc. Pub. No. 432. Bureau of Home Economics. Washington: U.S. Department of Agriculture.
- Liparito, K. (1985) "A comparative analysis of the early history of the southern and northern telephone systems." *Business and Economic History*, 2nd Ser., 14: 159-176.
- MacMeal, H. B. (1934) *The Story of Independent Telephony*. Chicago: Independent Pioneer Telephone Association.
- Mason, C. F. (1945) "America's farm telephone program is well on its way." *Public Utilities Fortnightly* 36 (2) 7-19, 85-98.
- Mathias, P. (1934) "The rural telephone situation." *Telephony* 107 (22 December): 8-11.
- Mattingly, P. F., and G. Aspbury (1985) "Some devolutional similarities diffusion." *Geografiska Annaler* 67B (1): 1-6.
- McDonald, F. (1957) *Let There Be Light: The Electric Utility Industry in Wisconsin 1881-1955*. Madison, WI: American History Research Center.
- Melvin, B. L. (1931) *The Sociology of a Village and Surrounding Territory*. Bulletin No. 523, Ithaca, NY: New York State Agriculture Experimental Station.
- Moline, N. T. (1971) *Mobility and the Small Town, 1900-1930: Transportation Change in Oregon, Illinois*. Department of Geography Research Paper No. 132. Chicago: University of Chicago.
- Monroe, D., et al. (1941a) *Family Income And Expenditures, Five Regions:*

- Part 2 Family Expenditures. Consumer Purchases Study, Farm Services. Bureau of Home Economics. Misc. Pub. No. 465. Washington, DC: U.S. Department of Agriculture.
- (1941b) Family Expenditures For Automobile and Other Transportation. Five Regions. Consumer Purchases Study, Urban, Village, and Farm. Bureau of Home Economics, Misc. Pub. No. 415. Washington: U.S. Department of Agriculture.
- Mulrooney, J. B. (1937) "Some Aspects of Rural Telephone Service," *Telephony* 112 (9 January): 14-16.
- Nagel, J. and Nagel. n.d. Talking Wires: The Story of North Dakota's Telephone Cooperative. Aberdeen, ND: North Dakota Association of Telephone Cooperatives (photocopy at Museum of Independent Telephony, Abilene, KA).
- Ohio Farmer. (1927) "Have you a telephone problem?" (2 July): 3.
- Pacific Telephone and Telegraph Company. (1945) "Memorandum on F. C. C.'s report, 'Preliminary Studies . . .' [1944]." In California P. U. C., 1960 [see above].
- Page, A. W. (1941) The Bell Telephone System. New York: Harper and Row.
- Parker, F. E. (1938) "Cooperative telephone association 1936," *Monthly Labor Review* 46 (2) February: 392-413.
- Patten, W. (1926) *Pioneering the Telephone in Canada*. Montreal: Telephone Pioneers.
- Pegg, M. (1983) *Broadcasting and Society, 1918-1939*. London: Croom-Helm.
- People's Mutual Telephone Company (1976) *It's For You: A History of People's Mutual Company Co.* Gretna, VA: People's Mutual (copy in Museum of Independent Telephony, Abilene, KA).
- Pike, R., and V. Mosco (1986) "Canadian consumers and telephone pricing." *Telecommunications Policy* (March): 17-32.
- Pool, I. de S. (ed.) (1977) *The Social Impact of the Telephone*. Cambridge, MA: M.I.T. Press.
- (1983) *Forecasting The Telephone*. Norwood, NJ: Albex.
- Rae, J. B. (1965) *The American Automobile: A Brief History*. Chicago: University of Chicago Press.
- (1971) *The Road and the Car in American Life*. Cambridge, MA: M.I.T. Press.
- Rakow, L. F. (1987) "Gender, communication, and technology: A case study of women and the telephone." Ph.D. Dissertation, University of Illinois at Urbana-Champaign.
- Renshaw, E. F. (1962) "Experience of the United States in bringing modern telephone service to unserved areas," in Agency for International Development (ed.), *Science, Technology and Development*, Vol. 12: Communications. Washington, D.C.: National Technical Information Service: 67-81.
- Reitz, K. P., and M. Dow (1985) "AUTCOR: An autocorrelation regression package." Orange, CA: K. Reitz and M. Dow (Chapman College).
- Robertson, L. and K. Amstutz. (1949) *Telephone Problems in Rural Indiana*. Purdue University Agricultural Experiment Station Bulletin 548 (September). Lafayette, IN: Purdue.
- Rogers, E. (1983) *Diffusion of Innovations*, Third Ed. New York: Free Press.

- Rural Electrification Association. 1974. "Twenty-five years of progress: Rural telephone service USA." Washington: U.S. Government Printing Office.
- Sage, L. L. (1983) "Rural Iowa in the 1920s and 1930s: Roots of the farm depression." *Annals of Iowa*, 3rd. Ser., 47 (Fall): 91-103.
- Schmitt, R. G., Jr. (1951) "Farmers' mutual telephone companies." *Journal of Farm Economics* 33: 1 (February): 134-139.
- Shenk, N. O. (1944) "Small exchanges struggle for survival." *Telephony* 127 (October 7): 20-23; (November 11): 13-14; (December 9): 34-36.
- Sichter, J. W. (1977) "Separations procedures in the telephone industry." Cambridge, MA: Harvard University Program on Information Resources Policy Paper P-77-2.
- Spasoff, I. M., and H. S. Beardsley (1922) (rev. 1930). *Farmers' Telephone Companies: Organization, Financing and Management*. Farmers' Bulletin No. 1245. Washington: U.S. Department of Agriculture.
- Sullivan, G. D. (1931) "The farmer and his telephone." *Telephony* 106 (6 June): 19-21.
- Taylor, I. D. (1980) *Telecommunications Demand*. Cambridge, MA: Ballinger.
- Telephony (1933) "Rural rates and development factors." 104 (3 June): 30-31.
- Telephony (1935) "Telephone communication in Iowa." 109 (2 November): 7-11.
- Tomblein, R. L. (1931) "Population changes in small communities and in rural areas." *Bell Telephone Quarterly* 10 (April): 115-123.
- U.S. Bureau of the Census (1906) *Special Reports: Telephones and Telegraphs 1902*. Washington: Government Printing Office.
- (1910) *Special Reports: Telephones: 1907*. Washington: Government Printing Office.
- (1915) *Telephones and Telegraphs . . . 1912*. Washington: Government Printing Office.
- (1920) *Census of Electrical Industries: 1917: Telephones*. Washington: Government Printing Office.
- (1924) *Census of Electrical Industries 1922: Telephones*. Washington: Government Printing Office.
- (1930) *Census of Electrical Industries 1927: Telephones*. Washington: U.S. Government Printing Office.
- (1934) *Census of Electrical Industries 1923: Telephones and Telegraphs*. Washington: U.S. Government Printing Office.
- (1939) *Census of Electrical Industries 1937: Telephones and Telegraphs*. Washington: U.S. Government Printing Office.
- (1942) *U.S. Census of Agriculture: 1940. Vol. II, General Reports*. Washington: U.S. Government Printing Office.
- (1952) *U.S. Census of Agriculture: 1950. Vol. II, General Reports*. Washington: U.S. Government Printing Office.
- (1975) *Historical Statistics of the United States, 1790-1970*. Washington: U.S. Government Printing Office.
- U.S. Bureau of Labor Statistics (1945) *Family Spending and Saving in Wartime*. Bulletin No. 822. Washington: U.S. Government Printing Office.
- U.S. Congressional Budget Office (1984) "Local telephone rates: Issues and alternatives." Staff Working Paper (January). Washington: Congress of the United States.

- U.S. Department of Agriculture (1938-1939) *Income Parity for Agriculture, Part III, Prices Paid by Farmers for Commodities and Services. Section 2. Rates for Electricity for the Farm Home (Preliminary, September, 1938); Section 3. Telephone Rates to Farmers (Preliminary, December, 1938); Section 5. Index Numbers of Prices Paid by Farmers for Commodities (Preliminary, May, 1939).* Washington: U. S. D. A.
- U.S. Federal Communications Commission (1939) *Investigation of the Telephone Industry: A Report of the F. C. C.* Washington: U.S. Government Printing Office.
- (1944) "Preliminary studies on some aspects of the availability of landline wire communications service". (October) Accounting Statistical, and Tariff Department. Economics Division. Washington: F. C. C.
- U.S. House (1949) "Rural telephones. Hearings." The Committee on Agriculture. 81st Congress. Washington: U.S. Government Printing Office.
- U.S. Senate (1909) *Report of the Country Life Commission.* 60th Congress, 2nd Session, Senate Document 705. Washington: U.S. Government Printing Office.
- (1949) "Rural telephones. Hearings." Committee on Agriculture and Forestry. 81st Congress. Washington: U.S. Government Printing Office.
- West, J. (C. Withers) (1945) *Plainville, U.S.A.* New York: Columbia University Press.
- Westrum, R. (1983) "What happened to the old sociology of technology?" Paper presented to the Society for Social Studies of Science, Blacksburg, VA. (November).
- Wik, R. M. (1972) *Henry Ford and Grass-Roots America.* Ann Arbor: University of Michigan Press.
- (1977) "The radio in rural America during the 1920s." *Agricultural History* 55 (October): 339-350.
- Wilkenson, L. (1985) *SYSTAT.* Evanston, IL: Systat, Inc.
- Winner, L. (1977) *Autonomous Technology: Technics-Out-Of-Control as a Theme in Political Thought.* Cambridge, MA: M.I.T. Press.
- Wolman, L. (1929) "Consumption and the standard of living." In *President's Conference on Unemployment, Recent Economics Changes in The United States.* New York: McGraw-Hill: 13-76.
- Wonbacher, G. F. (1908) "Proper development of the rural telephone." *Western Telephone Journal* 12 (July): 242.
- Woody, C. H. (1933) "The growth of governmental functions," in *President's Commission on Recent Social Trends, Recent Social Trends.* New York: McGraw-Hill: 1274-1330.



