

# Economic Impact of Secondary Road Improvements

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This paper reports the methodology and analyzes some of the major conclusions drawn in a recent study of the economic impact of rural road improvements in a six-county rural Kentucky area. It examines the basic hypotheses made and tested, and attempts to suggest how and to what extent the analysis and major findings of the Kentucky study may be applicable to other rural areas.

The study was conducted over a relatively large and varied geographical area for the period 1950 to 1960 and relied heavily on data from field investigation. The area was large enough to allow comparison of market structures in instances where there had been substantial road improvements with market patterns in similar cases where few all-weather rural roads exist.

•A GREAT MANY land value studies have been made in connection with highway economic impact research, most of them in urban areas (1). There have also been a number of analyses of rural land value differentials associated with road improvements, distance from hard-surfaced roads, type of road on which a farm is located, and location with respect to trade centers. Such studies of the impact of rural road improvements on farm property values have recently been made in Washington, Minnesota, Michigan, and Texas. A comprehensive National statistical analysis of rural property sale price differentials has been made by Longley and Goley (2). These studies have contributed valuable insights into the price per acre differentials existing between properties by type of road surface, distance to nearest trade center, and type of farm operation.

The primacy of tobacco as a cash crop in much of Kentucky renders a study of increased land values through transportation improvements' increasing of farm incomes by improving marketing efficiency of doubtful value. Tobacco is a high-value crop marketed only once a year, and the farmer hauls it to market himself or contracts for delivery to an auction. On-the-farm purchasing of tobacco is rare. Further, the size of the tobacco base which a farm is allotted is an important institutional factor determining the productive value of land in the State. Indeed, acreage allotments are common and their effects on land values have been studied in many States.

One dimension of the economic impact of highway improvements in rural areas which has received little attention in recent research is the effect of improved rural roads on the trading patterns of rural residents. Insofar as rural road improvements change trading patterns of rural people, they indirectly alter retail trade areas and may lead to economies of scale. Higher rural standards of living may thus follow through real income increases. Such increases can result from lower prices and wider selection of goods and services.

Patterns of family purchasing and the opportunity to travel to other counties to purchase goods freely are changing rapidly in rural Kentucky. The State's rural population is decreasing rapidly. Per capita income in many rural, nonmining counties,

though low, is increasing at a rate much above the average for the State. These rises are partially the result of losing underemployed and unemployed population, of farm consolidation, and indirectly of the postwar improvement of rural roads throughout the State.

Locally quite rugged terrain has made road improvements in rural Kentucky expensive and long delayed in coming. In addition, this terrain and the propensity of many Kentuckians to cling to family property have impeded the development of commercial agriculture by retarding the aggregation of farms into economic size units. These conditions have prevailed, particularly in the Cumberland foothills area and in the western coalfields, both areas of primarily small subsistence level farm units.

In 1960 the Bureau of Business Research of the University of Kentucky initiated a study, on which this paper is based, to investigate the degree to which the location of retail business, the extent of retail markets and purchasing patterns of rural families, and the distribution of goods at the wholesale level are visibly affected by over-all road improvements in underdeveloped rural areas. This paper reports the methodology and analyzes some of the major conclusions drawn in this investigation. It examines the basic hypothesis tested and suggests how the findings of the Kentucky study may be applicable to other rural areas.

A six-county area in northeastern Kentucky was selected for study. This area includes Bath, Carter, Elliott, Menifee, Morgan, and Rowan counties. The topography of these counties is varied. Many of the topographic problems of communication and transportation which have typified rural Kentucky in the past are found in these six counties. Most of the physiographic area classifications of Kentucky are exhibited. In general, the area is one of hill and bottom farming, much of it the subsistence type. Topography was a major determinant of settlement patterns, lines of communication and transportation, and community association.

These six counties are losing population at rates typical of most rural Kentucky counties outside the soft coal regions. They are also experiencing increases in per capita income.

Perhaps the most important consideration in the selection of this area is that the counties included are apparently only moderately influenced by major trade centers. A Kentucky market area study (3) reported out-of-county shopping goods business of the present study area divided between Ashland, Ky., to the east and Lexington, Ky., to the west. Traffic flow maps seem to substantiate further the hypothesis that the study counties constitute an area in which the market boundaries are fluid and for which the roles of the dominant and subordinate trade centers are in the process of being determined. It is believed that in such an area the effects of changes in transportation facilities and improved access to given trade centers might be more readily apparent than in more structured market hierarchies. Further, such effects might become apparent within a short period after the completion of road improvements.

#### STUDY METHOD

The basic assumptions underlying the methodology of this impact study are that (a) if there are identifiable economic impacts of rural road improvement, they are likely to show up in market structure changes; and (b) it is more productive to study improvements in rural road networks than to study isolated road improvements. With respect to the latter assumption, it is particularly appropriate to add that, although the effects of one secondary road improvement, or the improvement of a small section of such a road, may be small or at least so diffused as to defy identification, the effects of continued development of a secondary road network may be significant enough to be identified and to some extent measured.

To determine the effects of rural road improvements in the study area, and to compare the area with other areas, a three-pronged plan of investigation was adopted. Interviews were conducted with business proprietors in the study area to determine succession of business, changes in merchandise lines, and changes in open-country business location over an 11-year period back to and including 1950. These interviews covered all businesses operating in the six counties in 1960, and in addition those that had failed in the 11-year period.

It is the purpose of this part of the analysis to reconstruct locational patterns for retail business in the study area and to show how these patterns have changed. Secondary road improvements are related to these changes to see whether, and to what extent, their influence is apparent.

Second, the relationship of certain key variables to the dispersion of retail business is tested by a multiple regression analysis. Of particular concern is the relationship between changes in retail business dispersion and the proportion of farms on all-weather roads. Census of agriculture, census of population, and county income estimates for Kansas, Kentucky, and Iowa are used. This approach is aimed at getting a first approximation of the efficiency in the distribution of commodities in a rural area and the role of roads in such efficiency. It is assumed that greater geographical dispersion of retail business suggests less store specialization, few economies of scale, and relatively small market areas for any given store.

Third, interviews, conducted with roughly 10 percent of the farm operators in the six-county area, seek to determine where various types of commodities and services are obtained. This sample is stratified by location with regard to major trade centers, by county of residence, and by location in one of four physiographic classes. Analysis of the data is expected to show the influence of the type of access of farms to hard-surface roads, for example, on the purchasing habits of the farm family. In addition to farm-purchasing patterns, the interview schedule also covers the marketing of farm products.

## RETAIL BUSINESS STUDY FINDINGS

Perhaps the most interesting and important inferences of this study are drawn from the analysis of retail business change over the study period. The following sections of this report are limited to this aspect of the over-all investigation. Adjustments in retail business in particular counties in the study area (Fig. 1) are illustrated by considering shifts in the location of retail business in Elliott County. Over-all retail business changes are shown by indicating what has happened to the various trade centers in the study area as a whole. The concluding section of the paper presents an attempt to measure the degree to which changes in retail business dispersion in rural areas, such as the one studied, are attributable to road improvements.

### Changes in Elliott County

Martinsburg, known generally as Sandy Hook (Fig. 2), is the county seat of Elliott County and is its main trade center. However, its businesses serve only part of the county. Grayson, in Carter County to the north, is a strong competitor for the business of northeastern Elliott County in the area around Stephens, whereas residents of the northwestern part of the county make a large share of their purchases in Morehead in Rowan County. Topography rather than distance appears to be a principal factor limiting Sandy Hook as a competitor for the trade of the whole county. Road conditions also contribute to the relative isolation of some sections of the county from Sandy Hook. For instance, there is a 4.5-mi stretch of gravel road between Culver and Ky 32 which is difficult to negotiate. The existence of this poor road link helps to explain why residents adjacent to Ky 486 and its feeders trade in Grayson although Grayson and Sandy Hook are roughly equidistant from Stephens (Fig. 2).

In 1938, there were 73 businesses in the county outside Sandy Hook. The majority (47) were in isolated locations. Ten were in centers with 2 businesses, and 16 in centers with 3 or 4 businesses. Sandy Hook, itself, was very small with only 4 retail businesses. The county market was basically unstructured; i. e., no clear hierarchy of trade centers existed.

By 1950, Sandy Hook had grown substantially, and 24 businesses were located in or adjacent to the town's area of development. At this date only 59 businesses remained in out-county locations, and 38 of these were in isolated locations. Of the remaining 21, 12 were in centers with 2 businesses and 9 were in locations with 3 businesses.

The distribution of business openings and closings in this period related to distance from Sandy Hook is shown in Figure 3. It can be seen that closings are grouped in an area near Sandy Hook, and openings are located farther away.



Figure 1. Location of study area counties.

There were few open-country businesses which opened or closed in the period 1950-55. Only 4 new open-country locations were brought into operation; all, however, were at the junctions of secondary and feeder roads. Between 1955 and 1960, 12 businesses in out-county locations closed and 5 opened. With but one exception, the businesses closing were single isolated businesses.

The changes in location can be viewed graphically in two ways: (a) the area around Sandy Hook in which new businesses were opened in the periods 1938-50, 1951-55, and 1956-60, and (b) the distribution of businesses by distance from Sandy Hook in 1938, 1950, 1955, and 1960.

Figure 4 shows that the area around Sandy Hook in which new businesses were located has generally shrunk from period to period. Thus new business locations have been in more central or concentrated positions.

The distribution of businesses around Sandy Hook changed considerably between 1938 and 1960 (Fig. 5). In 1938, businesses were located in a pattern or grouping roughly approximating the distribution of population in the county. Two major concentrations of business from the standpoint of distance from Sandy Hook were found. The first was between 3 and 5 mi from the county seat. The second was between 5 and 8 mi distant.

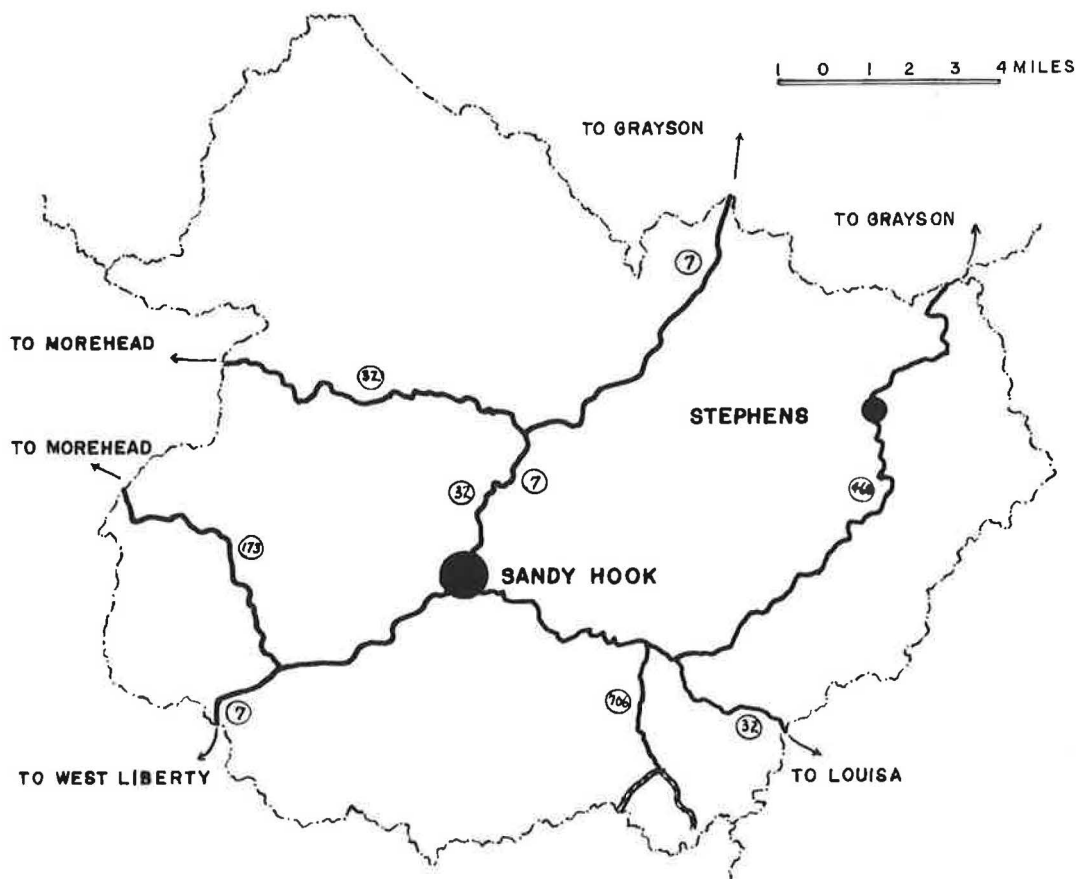


Figure 2. Major roads in Elliott County.

By 1950 this distribution had been altered considerably. The number of businesses in Sandy Hook was much larger than in 1938. This buildup was probably influential in shifting the location of the first exterior concentration of businesses from the 1938 position of 3 to 5 mi to a new position of from 3 to 6 mi, with the largest number in 1950 being 4 to 5 mi away as opposed to 3 to 4 mi away in 1938. In addition, the actual number of businesses in this area decreased from 16 to 11.

In 1950, a third area of concentration, not evident in 1938, was discernible: a buildup of locations 9 to 10 mi from Sandy Hook with twice the number of businesses that were so located in 1938. Of course, the number of businesses involved in this analysis is small, and shifts of small numbers one way or the other may lead to spurious conclusions. But in the periods discussed, locations related very well to new settlement and, in the case of contraction or centralization of activity, to presuppositions about the nature of preferable locations and experience in other study area counties.

In the period 1950 to 1955, the trend of 1938 to 1950 continued and, in a way, stabilized. Concentration of activity in Sandy Hook continued, and the two exterior concentrations of business remained in the same locations as in 1950. One difference is observable, however; the third buildup mentioned previously began to subside.

By 1960, the second and third buildups had merged, and there were only two buildups or concentrations within distance groups. The first was still located between 3 and 6 mi from Sandy Hook and contained 17 businesses. The third shifted outward and was located between 8 and 10 mi from Sandy Hook and contained 13 businesses.

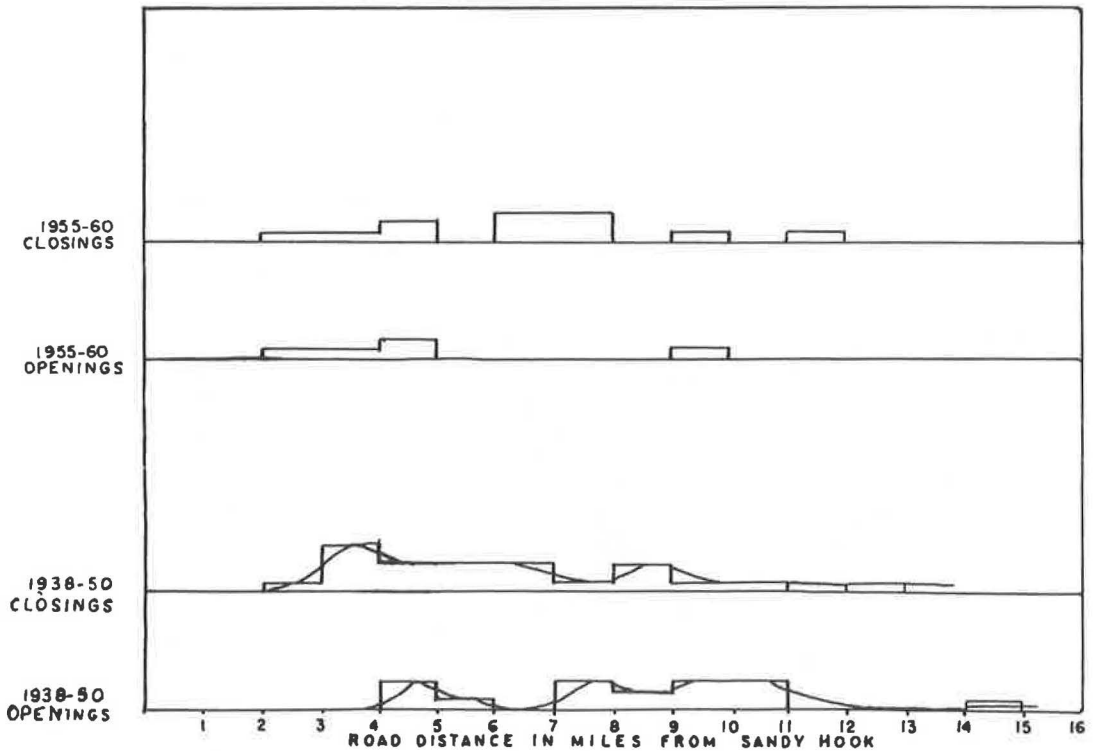


Figure 3. Business openings and closings by road distance from Sandy Hook, 1938-50 and 1955-60.

### Road Improvements, 1938-60

How did road improvements in Elliott County in this period relate to observed changes in the location of retail business? Two major secondary roads were surfaced in the period 1938-50. Both of these roads—Ky 7 through the county and Ky 32 from its junction with Ky 7 at Newfoundland to the Rowan County line—are intercounty roads and their improvement could be expected to contribute to the concentration of retail business. Sandy Hook with its governmental functions and fairly central location provides an ideal focus for business centralization. Both these roads were paved in the late 1940's, and it is reasonable to assume that their long-run economic effects would appear to some degree in the 1950's.

Sandy Hook's business concentration grew phenomenally from 1938 to 1950. This growth was partially the result of World War II's effects on the incomes of commercial farms, but it was also the result of the two major road improvements facilitating inter- and intracounty travel. In the period 1951-55 after the improvement of these two roads and during Ky 173 and Ky 32 east of Sandy Hook were paved, openings of new businesses were confined to these improved collector roads, and to the northwestern portion of Elliott County which was not settled until the 1940's. Sandy Hook's business district grew substantially in this period. In the period 1955-60, during which time hard surfacing was mainly confined to short stretches of feeder roads, there occurred only a retrenchment along the four major road segments, and there was little business growth in Sandy Hook.

### Study Area Business Failures

The Elliott County illustration emphasizes the general contraction in the dispersion

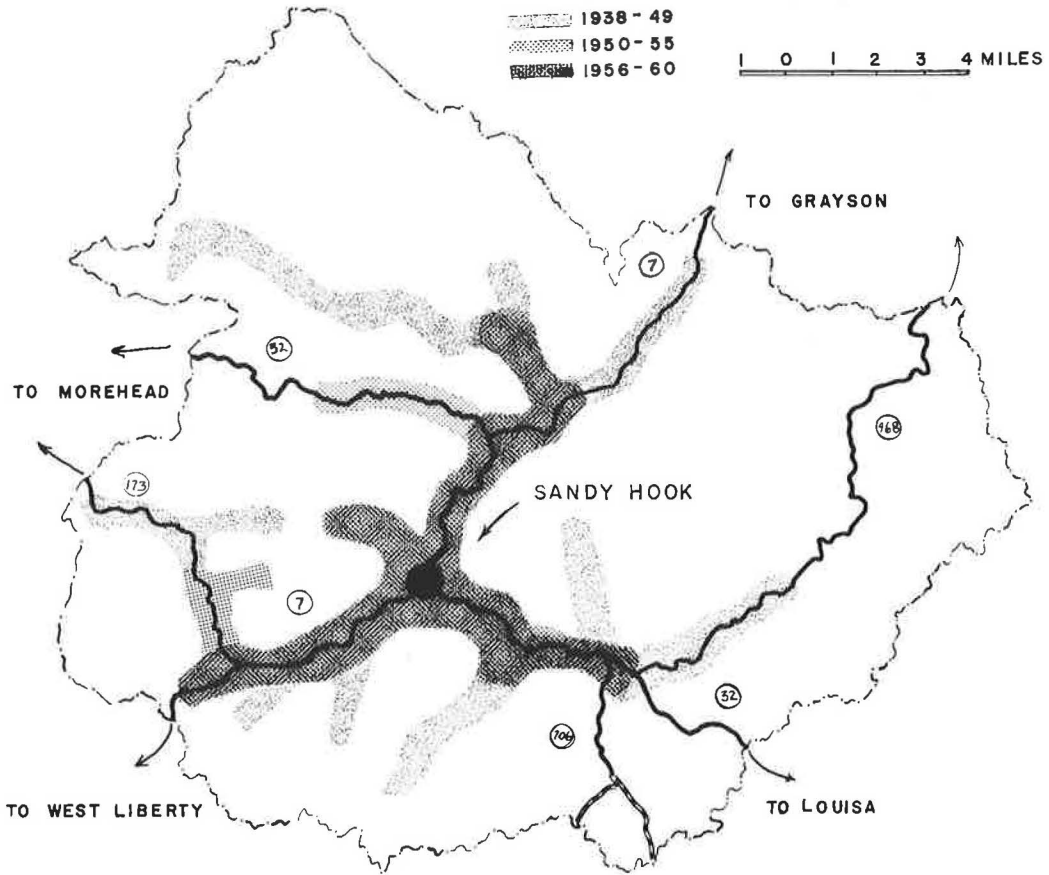


Figure 4. Location of new business near Sandy Hook.

TABLE 1  
TIME LAG AFTER PAVING OF NEAREST HARD-SURFACED ROAD AND  
CLOSING OF OPEN-COUNTRY BUSINESS<sup>1</sup>

Timing	Type of Business Location					
	Single		Isolated		Agglomerations	
	No.	%	No.	%	No.	%
Before	12	14	5	11	-	-
Same year	9	10	2	4	-	-
Years after:						
1	11	13	7	16	-	-
2	8	9	2	4	-	-
3	5	6	4	9	-	-
4	4	4	3	7	-	-
5	4	4	-	-	-	-
6	2	2	1	2	-	-
7	1	1	-	-	-	-
8	2	2	-	-	-	-
9	3	3	-	-	-	-
10 or more	24	28	21	46	14	100

<sup>1</sup>Source: Bureau of Business Research, University of Kentucky.

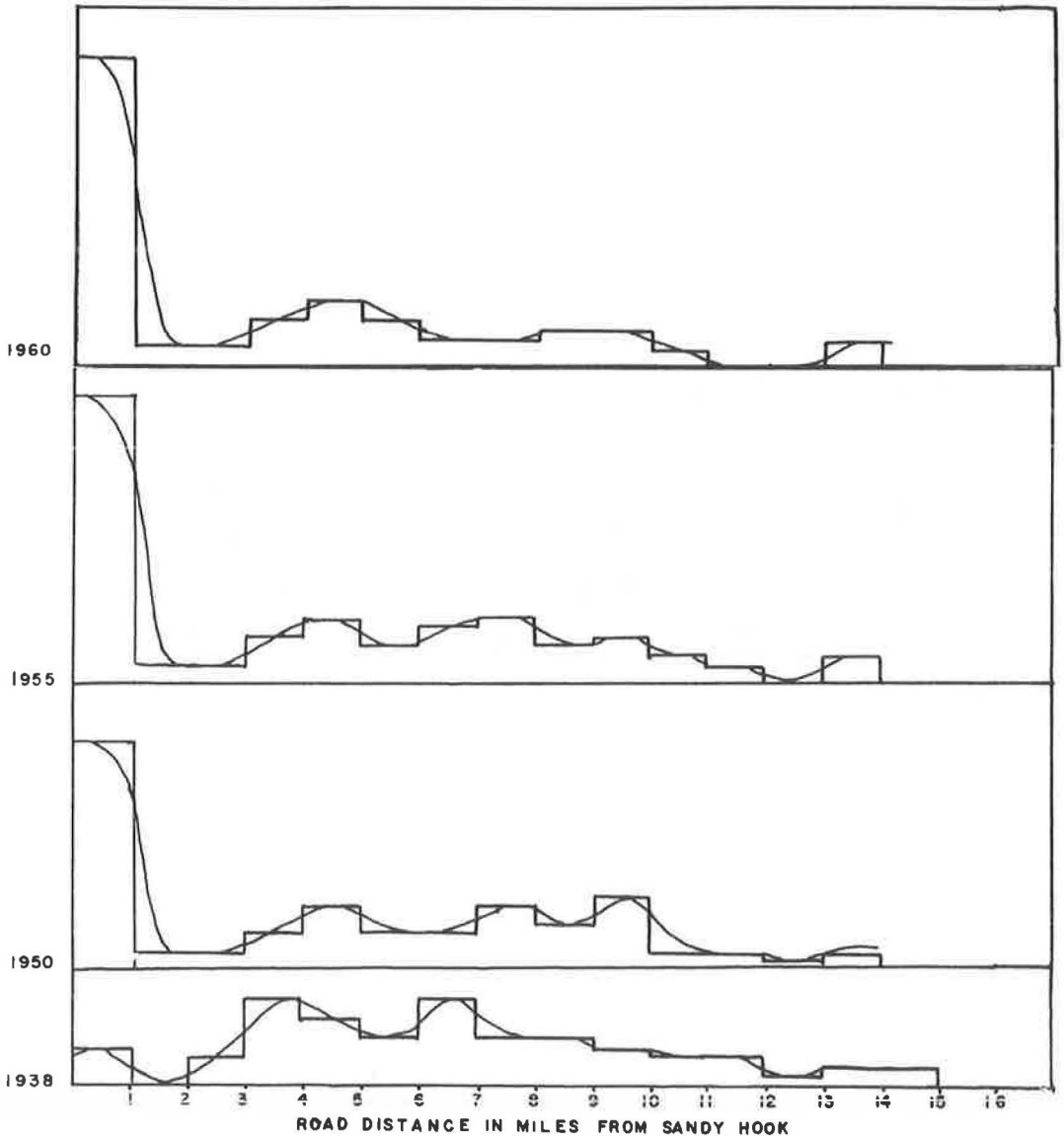


Figure 5. Business distribution by road distance from Sandy Hook: 1938, 1950, 1955, and 1960.

of retail business around the central trade center. This tendency is also observable in the study area as a whole. It is shown in a striking way by the record of business failures.

The survey of businesses in the study reveals a sufficient number of failures to warrant a classification of open-country locations into three groups: single isolated, dual isolated, and agglomerations. Using these three business location classes, failures are related to the nearest road improvement. The results of this analysis are given in Table 1, which shows that stores in single isolated open-country locations appear to be the most sensitive to surfacing of roads as is suggested by the preceding analysis of business concentration in Elliott County. Slightly under one-half the stores in such loca-



tions in the study area that failed closed within five years following the date when the nearest hard-surfaced road was paved.

The evident influence of such road improvements decreases as the degree of locational isolation of open-country business decreases. For example, of the open-country stores in agglomerated locations, all those closing failed ten years or more after the paving of the nearest hard-surfaced road. All the businesses so involved were located on an inter-county route or on an intracounty collector and were likely benefited initially by such improvements.

### Changes in Study Area Trade Centers

The business interviews also provide data with which to trace changes in the number and types of retail business establishments located in study area trade centers between the years 1950 and 1960. These observed changes are compared with rural road improvements in the area to uncover such relationships as exist.

The growth characteristics of the larger centers are markedly different from those of the small ones. Over-all, the larger centers showed roughly a 40 percent increase in the number of operating businesses between 1950 and 1960. However, not all the larger communities grew at the same rate. Each trade center's location in relation to other centers and in relation to the larger centers of Lexington and Ashland outside the study area was influential.

In the smaller trade centers as well as in the larger trade centers, food stores as a group became proportionately less important as a component of the business picture. New businesses, other than grocery stores, were initiated in the trade centers of the study area during the period 1950 to 1960, but these were concentrated in the larger trade centers.

In the six larger trade centers, 10 types of businesses increased in number at a rate greater than the over-all number of businesses. Three of these business types were "highway oriented"—restaurants, gasoline service stations, and motels. The other business types, however, reflect increased specialization and concentration in services and durable goods. Personal service and repair shops both grew at high rates between 1950 and 1960. But the fastest growth rate was in "specialty shops"; i. e., jewelry stores, florists, and gift shops. The other retail lines that grew rapidly were home furnishings and appliances, automobile sales, lumber and building materials, and farm supplies.

The changes in the number of businesses located in the study area trade centers best indicate the form and substance of the adjustments in market structure evolving within this rural area. In 1950 the three largest communities—Morehead, Olive Hill, and Grayson—already contained large concentrations of business; Owingsville, Sandy Hook and West Liberty were not significantly larger than the other small trade centers which remained static in the period 1950 to 1960. West Liberty and Owingsville grew substantially in this decade, and by 1960 West Liberty was an important center in the southwest portion of the study area.

The most decentralized locations, those described in this report as open-country locations, decreased in number; and those open-country locations used were within smaller radii circumscribed about the county seat trade centers. The "small trade center" (i. e., under twenty businesses) remained fairly static. Its absolute trade position was altered only slightly but its relative importance decreased. The business communities of the larger trade centers, primarily the county seat towns, increased in the size and diversity of the goods and services that they offered.

In 1950 there were only 398 mi of hard-surfaced roads in the six study area counties. During the next five years only 120 additional miles of road were surfaced. But between 1955 and 1960 slightly over 350 additional miles of road were hard surfaced. This was almost a 70 percent increase over the mileage existing in 1956.

It is obvious that the larger centers enjoyed increases in the number of retail and service businesses during the period of greatest activity in road improvement (as measured by miles of hard surfacing). It is equally clear that the greatest decline in the number of open-country businesses occurred during this same period. But these observed changes in the types and locations of businesses in trade area centers as well

as other retail business changes in the study area might very well be explained wholly or partially by changes other than road improvements.

### Aggregate Analysis of Changes in Retail Business Location

As a guide for assessing the changes in the geographic dispersion of retail business observed in the study area over the 10-year period an attempt is made to measure the relative influence of several variables on the dispersion of retail business in rural areas on a statewide basis. The technique used is multiple regression.

In the regression analysis the dispersion of retail business is taken as a measure of the degree to which a market is structured: the more structured the market, the less scatter of retail business expected. The scatter of retail business is used as the dependent variable.

The geographic dispersion of retail business is measured by the number of food and general stores per 1,000 population. It is believed that the number of general stores and food stores per 1,000 population gives an adequate approximation of the number of first-level or small consumer markets for the trade areas existing in a given political unit; in this case, the county.

A number of variables are considered in the analysis as determining the geographic dispersion of business:

1. Population density per square mile is used as an indicator of the potential population base for specialized and generally concentrated business.
2. Per capita income is used as a measure of the population's ability to buy and thus a further measure of the potential base for specialized and concentrated business activity.
3. The proportion of farms located on all-weather roads in a given county is used as an indicator of the "ubiquity" of a high level of transportation surface which could decrease time-distance factors in retail purchasing.
4. The proportion of commercial farms in a county is used as an indicator of the concentration of per capita income among consuming units.
5. The proportion of farm owner-operators in a county is used as an indicator of the familiarity of residents with local shopping alternatives and of possible neighborhood loyalty.

Before making the computations for the regression analysis, a forecast was made concerning the signs that the regression coefficients of each of the variables would have:

1. The sign of the regression coefficient for population density was expected to be negative because, all other things being equal, heavier population densities, should lead to specialization and thus to decreased dispersion of retail business.
2. The sign for per capita income was expected to be negative for the same reason.
3. The sign for the proportion of farms on all-weather roads was expected to be negative because increased ubiquity of a high level of transportation should decrease the influence of time and distance and thus lead to concentration of business. (The regression analysis does not distinguish between different types of hard-surface roads. The general study evidence strongly suggests that in a rural area improvement of roads to all-weather status is a more important determinant of the geographic dispersion of retail business than modernization of existing hard-surface facilities.)
4. The sign for the proportion of commercial farms was also expected to be negative because increased equalization in the distribution of income should make pressures for specialization more uniform and thus more effective in the location of retail business.
5. It was questionable whether the sign for the proportion of owner-operators was to be positive or negative, but it was forecast to be negative because income distribution and mobility were involved.

The multiple regression is assumed to take the linear form

$$X_1 = a + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 \quad (1)$$

TABLE 2  
RESULTS OF MULTIPLE REGRESSION FOR GEOGRAPHIC DISPERSION OF  
RETAIL BUSINESS BASED ON COUNTY  
AGGREGATIONS FOR 1940, 1950, AND 1960

Variable	Year <sup>a</sup>	Coefficient <sup>b</sup>	F-Test	t-Test
Population density	1940	0.026	2.48 <sup>c</sup>	1.58
	1950	-0.019	1.33	1.15
	1960	-0.036	9.41 <sup>d</sup>	3.07 <sup>d</sup>
Per capita income	1939 <sup>e</sup>	-0.029	1.51	1.23
	1950	-0.024	3.04 <sup>f</sup>	1.74 <sup>c</sup>
	1957 <sup>e</sup>	-0.027	2.99 <sup>f</sup>	1.73 <sup>c</sup>
Proportion of farms on all-weather roads	1940	-0.041	7.10 <sup>d</sup>	2.66 <sup>d</sup>
	1950	-0.042	7.69 <sup>d</sup>	2.77 <sup>d</sup>
	1960	-0.027	3.81 <sup>f</sup>	1.95 <sup>f</sup>

<sup>a</sup>Standard error: 1940, 1.17; 1950, 1.44; 1960, 1.14.

<sup>b</sup>Of determination: 1940, 0.50; 1950, 0.44; 1960, 0.37.

<sup>c</sup>Significant at 10 percent level.

<sup>d</sup>Significant at 1 percent level.

<sup>e</sup>1940 and 1960 data unavailable.

<sup>f</sup>Significant at 5 percent level.

The regression equation using the cross-sectional county data for 1950 referred to previously is computed using standard methods and yields an  $R^2 = 0.44$ . The signs of all of the coefficients are negative, as expected, but only the first three variables are significant. Consequently, a second regression equation is calculated using only the first three independent variables. The  $R^2$  is again 0.44. The results of this second analysis are summarized in Table 2.

The most important of the variables appears to be the proportion of farms on all-weather roads. Its importance lends support to the hypothesis that road improvement can have significant effects on market relationships and adjustments. The coefficient of determination ( $R^2$ ) is high, considering the aggregation of the data on a county basis. First, the measure of population density used tends to obscure variations in the concentration and dispersion of population within a political unit. An attempt was made to substitute a form of "man-land" ratio other than population density. Population per acre in crops and pasture is utilized, but this measure overcompensates by treating dispersed small acreages as concentrated. Second, the per capita income figures employed are only estimates and contain imputed income values for the farm home as a residence and for the value of homegrown fruits, vegetables, milk, and meat. Third, and most important, the measure of the proportion of farms on all-weather roads is subject to some error. The census classes of farms on hard-surfaced roads and farms on gravel, shell, and shale roads are combined to prepare the estimate. There are undoubtedly a number of gravel, shell, or shale roads that are not "all-weather" roads, and the proportion of such roads in each county varies widely. In addition, topography imposes a great many barriers to free movement and exchange.

The development of market structures encompassing many counties and the emergence of a hierarchy of trade centers with distinct functions as inferred from the observations in earlier parts of this report should lead to the secular reduction of the operation of county units in Kentucky as convenience goods markets. County and other political boundaries should be blurred by increasingly available good transportation, and thus the evolving convenience goods markets should increasingly overlap county boundaries and take on configurations consistent with the patterns of dominant and satellite trade

centers as they in turn develop. If this type of evolution has been occurring in Kentucky, then a reduction of the correlation between the dispersion of grocery and general stores with personal income and available transportation should be expected secularly.

This possible trend is checked by the same type of cross-sectional analysis as that for Kentucky counties with 1950 data. Using the same dependent and independent variables multiple regressions are calculated using data for circa 1940 and circa 1960. It is postulated that if the inferred market adjustments are prevalent in the aggregate, the  $R^2$  in 1940 should be higher than that for 1950 and the  $R^2$  for 1960 should be much lower than that for 1950. Of particular interest is the reduction in the  $R^2$  between 1950 and 1960 because the greatest activity in rural road improvement, as measured by number of miles hard surfaced, occurred in this period.

Analysis of data for 1940 and 1960 yields results in line with those previously hypothesized. The coefficients of determination ( $R^2$ ) for 1940, 1950, and 1960 are 0.50, 0.44, and 0.37, respectively. Proportionately, as well as absolutely, the decrease is greatest from 1950 to 1960. The regression coefficient for the transportation variable in the equation is statistically significant for all three periods. The regression and correlation data for all three years are given in Table 2.

It is interesting that in 1960 the coefficient of population density is highly significant, and that from 1940 to 1960 the sign of the coefficient changes. Table 2 also shows that the signs of the coefficients of the other two variables remain negative throughout the period. One possible meaning of the change in sign of the coefficient for population density is that the period of business concentration in this rural Kentucky area was just beginning in the 1940's.

The reductions in the correlations observed over the 20-year period from 1940 to 1960 do not necessarily validate the role of road improvements as key factors in the market adjustments inferred from the retail business survey data. But there seems to be little doubt that the coincidence of road improvements and concentration of business into the larger study area centers is more than accidental.

#### SUMMARY AND CONCLUSIONS

The evidence of the investigation reported in this paper appears to validate the premise that road improvements in rural areas lead to market adjustments, specialization of enterprise, and concentration of business. The market adjustments in the study area are manifested in many ways. The number of stores in "open-country" locations has decreased, and in addition their dispersion geographically about the area—primarily county seat—trade centers has decreased secularly. Concurrently, the number of businesses in the trade centers has increased and many of the new businesses are specialized. Trade centers are also becoming differentiated by trade functions, and communities which twenty years ago were very similar have evolved quite differently. The differences in their evolution are definitely related to the location of road improvements, and also to the sequence of their improvement.

Analysis of the data shows that intracounty as well as intercounty market adjustments have taken place. Improvement of intercounty routes, and of intracounty "collectors" appears to be of primary benefit. Improvement of feeder roads providing access to the secondary system is also beneficial, but in general most of such benefit seems to come not from modernizing already hard-surfaced routes, but from upgrading roads to "all-weather" standards.

Perhaps the most significant aspect of the regression and correlation analysis is that the proportion of total variance in the geographic dispersion of retail business establishments explained by the regression equation has decreased secularly since 1940. This secular decline is interpreted as due to intercounty market adjustments which have decreased the validity of the county as an economic unit. The importance of the transportation variable in the regression equation supports the conclusion that such intercounty market adjustments are due in large part to the increased availability to rural people of good intercounty routes.

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