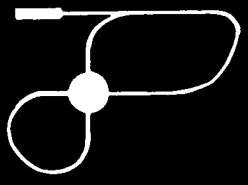
TRRL Supplementary Report 809



TRANSPORT and ROAD RESEARCH LABORATORY

DEPARTMENT of the ENVIRONMENT DEPARTMENT of TRANSPORT

Accessibility, transport costs and food marketing in the Ashanti region of Ghana

by

J. L. Hine (Transport and Road Research Laboratory),
J. D. N. Riverson and E. A. Kwakye (Building & Road Research Institute, Ghana)

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ACCESSIBILITY, TRANSPORT COSTS AND FOOD MARKETING IN THE ASHANTI REGION OF GHANA

ABSTRACT

The report examines accessibility, transport costs and food marketing in the Ashanti Region of Ghana. Its purpose is to determine how road investment may influence the pattern of producer and consumer prices and the structure of food marketing in southern Ghana.

An analysis of field data showed that the majority of food was initially sold at the farmer's house and at the local village market, travelling wholesalers being principally responsible for its onward movement to the urban market centres. Evidence was found of price discrimination in transport charges practised against the farmer who wished to take his own produce to urban markets.

The study found that improvement of the surfaces of existing roads would have only a negligible impact on prices paid to the farmer. However, replacing a footpath by a vehicle track may have a beneficial impact to the farmer of some one hundred times more than improving the same length of a poor quality road surface to a good quality gravel road. Little evidence was found of a loss of produce through roads becoming impassable to vehicle traffic.

Transport charges could account for only a small proportion of the wide differences in food market prices found throughout Ashanti Region. The major source of this variation is attributed to poor information and monopolistic marketing practices.

1. INTRODUCTION

The planning of rural road investment in developing countries can be improved by an understanding of how that investment may influence agricultural development, and subsequently, rural development in general. The Building and Road Research Institute in Kumasi (Ghana) and the Overseas Unit of the TRRL (UK) have collaborated in a study of the impact of feeder road investment in the Ashanti Region of Ghana; the work was undertaken for the Ghana Highway Authority and partially funded by the World Bank.

A two-fold investigation assessed the extent to which inaccessibility was acting as a constraint to rural development and the degree to which road investment might encourage agricultural change. The first investigation, which examined the relationship between accessibility and agricultural production is reported in Laboratory Report SR 791[1]. This report deals with the ways road investment may influence the pattern of producer and consumer prices, and the structure of food marketing.

2. BACKGROUND

The Ashanti Region of Ghana has an area of 24,000 sq km. Over a million people live in 2,500 small rural towns and villages dispersed widely over the Region, except for the uninhabited Afram Plains in the north east. The

Regional capital, Kumasi, (population 400,000) is the dominant market, transport and distributional centre of central southern Ghana and major roads in the Region radiate from there. It is estimated that some 98 per cent of the rural population of the Region lives less than 2 km from the 4,400 km of roads and motorable tracks that lie in the inhabited parts of the Region. Only 0.3 per cent of the rural population lives more than 5 km from a road or track.

Food crop cultivation and cocoa farming are the major sources of livelihood for most of the population. This is supplemented by the rearing of poultry, sheep and goats. Marketing, the provision of services, rural industry and hand crafts provide additional sources of income for a small proportion of the rural population.

Because land is relatively plentiful, shifting cultivation remains the dominant pattern of food farming. A plot of land is cropped for up to 3 years and then left to bush fallow for up to 10 years to regenerate the fertility of the soil. When the area is to be used again the land is cleared by fire. Large trees and tree stumps are left standing, and the open patches of land are cultivated with hand hoes. Machinery is largely inappropriate to this type of farming; labour (and working capital to hire additional labour) is a more critical factor of production, although modern inputs such as cocoa insecticide and fertilisers are widely used.

3. DATA COLLECTION

3.1 *Data sources*

The main emphasis of this report is on transport charges, vehicle operating costs (VOC) and market prices. Wholesale transport charges and wholesale and retail market prices were collected from the Ashanti Region Ministry of Agriculture Statistics Division. Vehicle operating costs were obtained from the Ghana Highway Authority and the Transport and Road Research Laboratory.

Information on crop movement and food sales was collected from a field study of 491 smallholders located in 33 villages in Ashanti Region. A separate survey of the villages provided data on passenger fares and the transport tariffs of individual loads of farm produce. The smallholder survey was carried out by Ministry of Agriculture enumerators; while project staff conducted the village survey. All but two of the villages in the sample had vehicle access and were between 8 and 102 km by road from Kumasi. The locations of the villages are shown in Figure 1 and are listed in Appendix 1. For convenience the villages have been grouped into 8 zones. Apart from the two villages in zone 7 in the savanna area to the north of the Region, all the villages lie in the cocoa growing forest area of the Region. A detailed description of the field surveys and an analysis of the main household farming characteristics is included in Laboratory Report SR 791[1].

3.2 *Survey timing and extraneous influences*

Field data for the study was collected during 1979. This was a period marked by high rates of inflation (in excess of 50 per cent per annum) and included a political revolution. Both of these factors influenced the pattern of food marketing, and the analysis was arranged to ensure that marketing and transport data related only to the period prior to the revolution. Prices were deflated to a common value.

4. THE STRUCTURE OF FOOD MARKETING IN ASHANTI REGION

The analytical framework of this section draws heavily on Gore's study of marketing in Eastern Region.[2,3]

The bulk of the food consumed in the Ashanti urban areas comes from the Region – particularly cassava, maize, cocoyam, plantain and the bulk of the fruit and vegetables. However, the area is dependent on meat and fish supplies from other regions. In addition much rice, yam, wheat flour and tomatoes are either imported or brought in from northern Ghana.

Food marketing in southern Ghana is dominated by a large number of independent operators, most of whom are women. They collect produce in rural areas (rural assemblers), arrange for its transport to town (travelling wholesalers), transport the produce (transporters), wholesale the produce in urban areas (non travelling urban wholesalers) and finally sell it to the urban population (retailers). The produce may pass through the hands of up to five intermediaries between farmer and urban consumer. Sometimes the chain is much shorter when the farmer sells directly in a local village for local consumption, or when he travels to town to sell directly to the urban consumer at the lorry park at his arrival point in the town. The marketing chain can also be longer if the produce is sold between wholesalers for onward movement to other urban markets.[4]

At each stage the market operator makes use of economies of scale, particularly the economies in the wholesale movement of produce by lorry. It is obviously a relatively expensive operation for the farmer to sell a small quantity of his produce in town. Not only must he pay a higher rate than the wholesaler to carry his one bag of maize but he must also pay his return passenger fare. In addition, he may also have extra expenses for food consumed in the town and he loses a day's labour on his farm. Meanwhile, the wholesaler is able to spread these costs over the much larger volume of produce that she is able to purchase with her much greater cash resources.

There is plenty of scope for monopolistic collusion at all stages in the marketing chain, to the disadvantage of the farmer and the final urban consumer. Gore[3] has argued that the limits to the exercise of this monopoly buying and selling power is governed by the total costs to the farmer (both in terms of cash and his own time) of taking his own produce to market and bypassing all intermediaries. In Ashanti Region, only a relatively small proportion is sold directly by the farmer in an urban centre.

More often than not the farmer sells his produce to only one travelling wholesaler or rural assembler with whom he has a long standing relationship. In fact, the farmer may have little choice in the matter because of an agreement between wholesalers who visit that village and allocate farmers between themselves. This tie may be strengthened by a credit relationship between the farmer and the wholesaler.

In most instances the farmer will be at a disadvantage in bargaining. The wholesalers who trade in the village will travel together and will tend to discuss prices and purchasing arrangements; they will also possess more up-to-date marketing information than the farmer. Generally, the farmers will be poorer than the wholesalers with whom they trade and for a significant number of farmers indebtedness will force them to sell at peak harvest time when prices are relatively low. Sometimes the travelling wholesaler can get into a vulnerable position relative to the farmer when, for example, a vehicle has been hired and there is a shortage of produce for sale or when there is a shortage of space on a vehicle and the wholesaler who has bought too much produce must pay the farmer to store it.

In times of excess demand (brought about by an acceleration of urban wages) or of a production shortfall (due to poor rainfall) the resultant rise in consumer prices will be delayed in being passed on to the farmers because of the rigidities in the marketing system. New competition attracted by the increase in profits to the intermediaries will find it relatively slow and difficult to break the established ties between farmers and travelling wholesalers.

At the major urban markets in the Region different food items are sold at different locations in the market so that, for example, yams will be sold together at one place and plantain at a different place. For each commodity, the non travelling wholesalers and retailers form themselves into associations of sellers. They will appoint a 'Yam Queen' or a 'Cassava Queen' to be in charge of the association and represent their interests. These sellers' associations have a social and representational purpose as well as an economic one. The association will organise funerals for members and the 'Queen' will represent the views of the members to the town authorities. The associations also enable the retailers to act as a cartel.

Attempts to control the market can be through enforcement of minimum prices (including actively discouraging the giving of large discounts or 'dashes'). More often the market can be controlled by trying to regulate the amount of produce that comes into the market. Gore[2] has indicated how fines have been imposed on traders and transporters who bring too much of one commodity into Koforidua in the Eastern Region. Likewise instructions have been issued to retailers not to buy from certain wholesalers who 'break' the rules.

The attempts to control are not always successful and limits are imposed on the level of retail prices by the competition from the presence of peripheral non association traders operating in other parts of the town and by those farmers who sell their produce directly at the lorry parks when they come into town from their villages.

5. THE INITIAL MOVEMENT AND SALE OF FOOD CROPS

The farm survey data given in Table 1 shows that the average distance between field and village was 3.9 km, but nearly three quarters of this distance was taken up by footpaths. It was only in zones 6 and 7 that motorable tracks and feeder roads counted for an appreciable component of the journey. No significant relationship was revealed by regression analysis between distance from field to village and the village's access to Kumasi or to the nearest district centre.

TABLE 1

Average distance from field to village (km)

Zone	5	2	3A	1	3B	6	7	4	All
Distance									
by foot path	3.7[1]	2.5	2.6	5.1	1.6	2.6	2.3	3.8	2.8
by track	0	0	0	0	0	0.3	2.3	0	0.4
by feeder road	0	0.3	0.1	1.1	0.1	0.7	1.1	0.2	0.4
by main road	0	0	1.2	0.9	0	0.4	0.3	0	0.3
Total	3.7[1]	2.8	3.9	7.1	1.7	4.0	6.1	4.0	3.9

[1]Small sample not completely representative.

NOTE: The ordering of the zones in this and subsequent tables has been arranged to be consistent with other publications issued by the Building and Road Research Institute, Kumasi.

In over 90 per cent of the households surveyed the principal means of carrying goods from the field was by headload. 50 per cent of the households reported that they used only household labour for this and 40 per cent said they either used hired labour only or a mixture of hired and household labour. Mechanical transport

transport was used to a significant degree only in zone 7 where tractors were reported as one of the principal means of transport.

The costs of moving an average headload of produce from farm to village, from village to district centre, and from village to Kumasi are shown in Table 2. The latter two sets of data are the tariffs the farmer must pay to take a small amount of produce by vehicle. In general the tariffs charged to market traders who buy and transport produce in bulk will be much lower. The relationship between the two tariffs are examined in more detail in Section 7.

TABLE 2

Average costs of moving one headload (Cedis, May 1979)

Zone	5	2	3A	1	3B	6	7	4	All
From farm to village ¢	3.0	2.3	1.6	2.8	2.4	2.3	4.8	3.5	2.9
From village to District Centre ¢	1.2	2.9	2.8	5.6	7.3	4.1	4.5	7.4	4.2
From village to Kumasi ¢	1.2	3.8	5.5	5.6	10.1	8.3	9.3	12.6	7.2

Table 3 gives a breakdown of the location of food produce sales. 57 per cent of holders in the survey sold their produce at their house and a further 24 per cent sold their produce at a village market. As a place for direct sale, Kumasi was an important market for the holders of zone 5 who lived very close to the city. Farm sales before harvesting, at the nearest point on a road, and sales at a district market were relatively less important.

TABLE 3

Location of food produce sales (per cent of holders)

Zone	5	2	3A	1	3B	6	7	4	Overall total
On farm before harvesting	11.2	7.0	0	9.7	7.1	0	4.8	0	3.8
Sent to house	31.6	39.5	83.0	32.3	92.9	71.3	79.5	48.4	57.4
Nearest point on road	5.1	3.0	1.4	12.9	0	7.2	0	2.6	4.0
Village market	1.0	46.0	14.1	45.2	0	13.9	15.7	37.4	24.3
District market	1.0	1.0	0	0	0	5.4	0	11.6	3.4
Kumasi	50.0	3.5	1.4	0	0	2.2	0	0	6.9

Table 4 shows the principal means of transport of food produce prior to sale by the farmer. Headloading, as may be expected from the above analysis, was the dominant form of transport, mentioned by 62 per cent of the holders. Hired transport was used to a significant extent only by holders in zone 7.

TABLE 4

Principal means of transport prior to sale (per cent of holders)

Zone	5	2	3A	1	3B	6	7	4	A11
Join available transport	91	20	31	8	0	17	9	35	27.9
Hire transport	0	0	2	0	0	0	28	0	3.2
Headload	9	78	67	92	100	73	22	65	61.9
Combination of above	0	2	0	0	0	10	41	0	6.9

Table 5 shows the relative frequency of the different crop sales reported in the survey. 55 per cent of the holders reported selling maize which was more widely sold than cocoa. Only 17 per cent of the holders reported selling cassava and 13 per cent reported selling plantain. Table 6 gives a breakdown by zone of the proportion of holders selling more than 30 per cent of their maize crop and more than 30 per cent of any food crop.

TABLE 5

Frequency of crop sales

Survey total of 491 holders in 33 villages:

269 holders reported selling maize	in 32 villages
179 holders reported selling cocoa	in 25 villages
83 holders reported selling cassava	in 23 villages
62 holders reported selling plantain	in 13 villages
5 holders reported selling tomatoes	in 4 villages
4 holders reported selling cocoyam	in 3 villages
4 holders reported selling rice	in 2 villages
3 holders reported selling yam	in 1 village
1 holder reported selling oranges	in 1 village
1 holder reported selling okra	in 1 village

TABLE 6

Produce sales

Zone	5	2	3A	1	3B	6	7	4
Per cent holders selling more than 30% of maize crop	51	48	42	33	42	54	80	62
Per cent holders selling more than 30% of any food crop	78	87	70	92	76	80	94	92

The analysis reported in Laboratory Report SR 791 found that within the range considered, accessibility (defined in terms of transport costs from village to Kumasi and to district centre) could not overall easily explain the proportion of farmers in a village selling food crops. Although the proportion of farmers selling more than 30 per cent of any crop including cocoa does apparently increase with inaccessibility it was suggested that this may be explained by other factors such as farm size and labour input which vary with accessibility.

A key indicator of poor and uncertain accessibility on agricultural performance is given by the incidence of rotten produce. Farmers were asked in the smallholder survey about this; Table 7 shows that in total 16 per cent of the survey holders had personal experience of produce becoming rotten before they could sell. Three villages, Mpasatia, Mpatoam and Nynahin (all of which had lower than average transport costs to Kumasi) accounted for nearly half of the reported cases. Table 8 gives the reasons identified by holders for their loss of produce. In total less than 5 per cent of holders (including all those giving multiple reasons) identified road condition as a cause for concern in this respect. It should be noted that the farmers were referring to particular instances over the last few years which they remembered. It appears that overall only a very minute proportion of produce was effectively lost because of poor road condition.

TABLE 7

Rotten produce before sale

Zone	5	2	3A	1	3B	6	7	4	All
Percent holders with 'rotten produce' experience before sale	0	44	10	100	3	4	0	8	16

TABLE 8

Farmers with personal experience of rotten produce before sale

	Holders	%
Identifying the following reasons:		
(1) Poor road condition hence no vehicles	13	2.9
(2) Road passable but no vehicles	7	1.6
(3) Late in harvesting produce	16	3.6
(4) No headloaders available to take produce	15	3.4
(5) Failure of transport arrangement including breakdown	0	0
(6) Storage problems, pests etc.	5	1.1
(7) No prospective buyers available	8	1.8
(8) Multiple reasons	9	2.0
Total farmers answering question	443	100

6. TRANSPORT FARES AND TARIFFS

6.1 *Farm produce transport tariffs*

An analysis of transport tariff data for the movement of wholesale quantities of maize, yam and plantain to Kumasi Central Market in August 1978 is shown in Table 9. As expected transport charges vary directly with distance moved; statistically significant regression relationships were found between distance and tariffs for maize and yam.

The average wholesale transport tariffs of the three commodities represent only a small component of their final price in the Kumasi market, namely 5.3 per cent for maize, 5.2 per cent for yam and 3.5 per cent for plantain. These figures are similar to but a little smaller than the average of 7 to 8 per cent found by Gore[2] in his study for marketing in Korforidua.

Table 3 has shown that over 80 per cent of food produce is first sold either at the farmer's house or at the village market and hence the majority of produce moves to urban markets in wholesale quantities. However it was argued in Section 4 that the price the farmer would be able to receive for his produce (in bargaining with wholesalers in his village) would be related to the total cost of moving his own produce to market. This includes the return passenger fare and the tariff for taking an individual load. Table 10 shows the charges that farmers reported they would have to pay to take their own produce to Kumasi and the district centres. Table 11 shows that passenger fares and the transport tariffs for moving individual bags of maize are statistically related to distance.

TABLE 9

Kumasi Central Market: Wholesale transport charges August 1978

Maize			
Regression of transport charges with distance per large bag (220 lb)			
¢ = 0.4845 + 0.0359 km	R^2 = 0.88	F = 132.4	Sig. at 0.1%
	20 observations		
Average maize transport charge ¢4.8, average distance 120 km			
August 1978 Kumasi price per bag of maize ¢91			
Average transport charges as proportion of final market price = 5.3%			
Yam			
Regression of transport charges with distance per 100 tubers			
¢ = 16.37 + 0.0405 km	R^2 = 0.21	F = 5.029	Sig. at 5%
	21 observations		
Average yam transport charge ¢24.33, average distance 197 km			
August 1978 Kumasi price per 100 tubers ¢467			
Average transport charges as a proportion of final market price = 5.2%			
Plantain			
Regression of transport charges with distance per seat (= 110 bunches)			
¢ = 49.21 + 0.0607 km	R^2 = 0.11	F = 2.724	Not sig.
	24 observations		
Average plantain transport charge ¢56.4, average distance 116 km			
August 1978 Kumasi price ¢14.5 per bunch (¢1595 per seat)			
Average transport charges as a proportion of final market price = 3.5%			

TABLE 10

Transport charges for small consignments of produce

From	To	Distance km	June 79 transport charge ¢	X 0.6825 (Inflation deflator) ¢	Destination market price (Aug–Oct 78) ¢	Deflated transport charge ÷ market price %
Large bag of maize						
Abonsuaso	Kumasi	89	20	13.7	87.2	15.7
Abonsuaso	Topa	31	10	6.8	74.9	9.1
Sekodumasi	Kumasi	77	7	4.8	87.2	5.5
Dwendwenase	Kumasi	96	20	13.7	87.2	15.7
Dwendwenase	Konongo		8	5.5	71.6	7.6
Mpasaso	Kumasi	74	20	13.7	87.2	15.7
Kente	Kumasi	71	10	6.8	87.2	7.8
Kente	Bekwai		5	3.4	68.3	5.0
Adobewura	Kumasi	58	10	6.8	87.2	7.8
Toase	Kumasi	25	6	4.1	87.2	4.7
Nyinahin	Kumasi	59	10	6.8	87.2	7.8
Winiso-Sekyikran	Kumasi	45	10	6.8	87.2	7.8
Dromankuma	Ejura	6	2	1.4	68.9	2.0
Mpatoam	Kumasi	48	10	6.8	87.2	7.8
Mpasatia	Kumasi	29	6	4.1	87.2	4.7
Kumeso	Kumasi	84	10	6.8	87.2	7.8
Kumeso	Konongo		8	5.5	71.6	7.6
Anwia-Nkwanta	Kumasi	37	6	4.1	87.2	4.7
Anwia-Nkwanta	Bekwai	8	3	2.1	68.3	3.0
Large bag of cocoyam						
Abonsuaso	Kumasi	89	20	13.7	175.5	7.8
Mpasaso	Kumasi	74	10	6.8	175.5	3.9
Kente	Kumasi	71	15	10.2	175.5	5.8
Kente	Bekwai		10	6.8	154.8	4.4
Chechewere	Kumasi	53	6	4.1	175.5	2.3
Chechewere	Bekwai	53	6	4.1	154.8	2.6
Bunch of plantain						
Mpasaso	Kumasi	74	1	0.7	14.7	4.7
Ahensan	Kumasi	59	2	1.4	14.7	9.3
Ahensan	Obuasi		1	0.7	13.3	5.2
Kente	Kumasi	71	1	0.7	14.7	4.7
Kente	Bekwai		1	0.7	13.6	5.0
Adobewura	Kumasi	58	1	0.7	14.7	4.7
Toase	Kumasi	25	1	0.7	14.7	4.7
Nyinahin	Kumasi	59	1	0.7	14.7	4.7
Chechewere	Kumasi	53	1	0.7	14.7	4.7
Chechewere	Bekwai		1	0.7	13.6	5.0
Mpatoam	Kumasi	48	1	0.7	14.7	4.7
Mpasetia	Kumasi	29	0.2	0.1	14.7	0.9
Anwia-Nkwanta	Kumasi	37	0.8	0.6	14.7	3.7
Anwia-Nkwanta	Bekwai	8	0.4	0.3	13.6	2.0
Obenebeng	Kumasi	76	3.5	2.4	14.7	16.3
Obenebeng	Bekwai		2.5	1.7	13.6	12.6

TABLE 11

Village survey data: transport tariffs to farmers June, 1979

Maize (small consignments)			
Regression of transport tariffs with distance per 220 lb bag			
¢ = 0.857 + 0.169 km	R^2 = 0.538	F = 12.8	Sig. at 1%
	13 observations		
Passenger fare			
Regression of passenger transport fares with distance			
¢ = −0.385 + 0.069 km	R^2 = 0.85	F = 142.7	Sig. at 0.1%
	27 observations		

6.2 *Evidence of price discrimination in transport tariffs*

Price discrimination is practised by virtually all transport operators ie. the prices which they charge for their various services have a far from constant relationship to the cost of providing these services.

Evidence has been collected which suggests that transporters operate a policy of discriminatory pricing against farmers wishing to take individual loads of produce to market. The transporter knows that the farmer can afford to pay more for taking a bag of maize to market than he would be willing to pay on a normal day to go to market himself; so in rural areas where traffic volumes are low and there is little competition the transporter is able to charge more in relation to costs for taking a bag of maize than for carrying a passenger.

The data in Table 12 shows estimated charges (based on relationships reported in Tables 9 and 11) of moving maize (in wholesale and individual loads) and passengers different distances. For a 50 km trip the charge for carrying an individual bag of maize is 2.4 times the charge for the same bag in wholesale quantities. This by itself is not conclusive evidence of discriminatory pricing because real economies of scale may possibly be involved.

However it is known that passenger vehicles suffer not from a weight constraint but from a volume constraint. Gore[2] suggests that this is also true for the average mammy wagon which takes both passengers and freight. Passengers cannot be stacked together as can bags of maize; they need seats and room to breathe. Nevertheless, freight flows may well be more peaked in a given direction from village to district market than passenger flows. If we assume that one passenger takes the space of two bags of maize and that freight flows are reduced by one third in one direction in comparison with the balance of passenger flows then the relative costs to the transporter of carrying a bag of maize relative to a passenger should be as follows:-

$$\text{Relative cost of carrying a bag of maize to a passenger} = \text{ratio of maize bag volume to passenger} \times \frac{\text{cost of two way vehicle trip}}{\text{total volume of freight to passengers for two way trip}}$$

$$= \tfrac{1}{2} \times \frac{2}{(1 + \frac{2}{3})}$$

$$= 3/5 \text{ of passenger unit costs}$$

Table 12 suggests that the ratio is 7 times this for a 20 km journey and 4½ times this for a 100 km journey. Even allowing for possible extra costs due to extra wear on the lorry from the higher weight density of freight, the figures provide additional evidence of discriminatory pricing.

Discriminatory pricing in this way has the effect of reducing the bargaining strength of farmers when selling their produce to travelling wholesalers; the wholesalers know how expensive it is for the farmer to take individual loads to market and so is able to bargain for a lower price.

TABLE 12

A comparison of maize and passenger transport charges at August 1978 prices

The following charges are calculated from Tables 9 and 11.
The survey data collected in June 1979 is multiplied
by 0.588 to bring it to August 1978 prices.

	Transport charge ¢		
	20 km	50 km	100 km
Wholesale transport charge (220 lb maize bag)	1.20	2.28	4.07
Farmer transport charge (220 lb maize bag)	2.49	5.47	10.4
Passenger transport charge	0.586	1.80	3.83

7. THE RELATIVE CHANGE IN FARMERS' PRICES FOLLOWING A ROAD IMPROVEMENT

To estimate the relative change in farmers' prices following a road improvement two key variables must be estimated. These are firstly the existing price offered for the farmer's produce in his village and secondly the reduction in transport charges that will follow the road improvement.

7.1 *The village price for produce*

Unfortunately it was not possible to collect farmers' produce prices in the field survey. This was for a number of reasons, including the lack of records kept by farmers, the high rates of inflation, the imperfect nature of the market and the sensitive nature of the subject. For the purposes of the analysis farm gate prices for maize, yam and plantain were derived by subtracting the wholesale transport charge, for different distances to Kumasi, from the Kumasi retail market price after an allowance had been made for wholesale and retail margins. Thus the price the farmer receives is shown to decline the further the distance from Kumasi. No change in the bargaining strength between wholesalers and farmers was assumed for the different distances used in the example. Following Gore[2] wholesale and retail margins were assumed to be 1/3rd of the final market price. Assuming 30 kms of main road and additions of 5 km, 20 km and 50 km of feeder roads, different producer prices were estimated for maize, yam and plantain; this data is shown in Tables 13, 14 and 15.

TABLE 13

Maize: calculated increase in farmers' price following rural road improvement

1978 August Kumasi price per 220 lb bag	=	¢91.00
Gross wholesaler and retailer margins at 33%	=	¢30.03
Combined transport and producer price	=	¢60.97

Regression of transport charges with distance

¢ = 0.4845 + 0.0359 km R^2 = 0.88 F = 132.4 Sig. at 0.1%

20 observations

Average maize transport charge ¢4.8 Average distance 120 km

All items with 30 km of main road	Length of road improvement		
	5 km	20 km	50 km
1. Calculated transport charge ¢	1.74	2.28	3.36
2. Calculated producer price ¢	59.23	58.69	57.61
Calculated reduction in transport charge ¢ (and percentage increase in producer price)			
3. TRRL Option 1	0.01 (0.02%)	0.04 (0.07%)	0.1 (0.17%)
4. Scott Wilson Kirkpatrick Option 2	0.057 (0.1%)	0.23 (0.39%)	0.57 (1.0%)
5. TRRL Option 3	0.015 (0.02%)	0.06 (0.1%)	0.12 (0.2%)
6. Scott Wilson Kirkpatrick Option 4	0.11 (0.18%)	0.42 (0.7%)	0.98 (1.7%)
7. Average percentage increase in price of 4 options	(0.08%)	(0.32%)	(0.77%)

7.2 *The reduction in transport charges*

Two sources of vehicle operating cost data were used to calculate the proportionate change in transport costs that would result from improving earth roads to a good gravel road standard. Estimates of vehicle operating costs were drawn from the 'Road vehicle operating cost manual' for the Ghana Highway Authority prepared by Scott Wilson Kirkpatrick and Partners and The Economist Intelligence Unit[5], and from 'Tables for estimating vehicle operating costs on rural roads in developing countries' compiled by TRRL[6].

In order to calculate the resulting change in transport charges two alternative approaches were adopted that differed in their treatment of standing charges. The first applied the proportionate change in vehicle operating costs to the slope component of the regressions shown in Table 9, relating wholesale transport costs to distance travelled. It was reasoned that the constant component reflected standing charges plus loading and unloading costs, and hence would not be affected by an improvement in road surface.

The second approach calculated the proportionate change in vehicle operating costs from a build up of total calculated transport costs for the different total journey lengths. The overall proportionate change in transport cost was then applied to the overall transport charges calculated for the different distances so that a second estimate of the reduction in transport charges could be made.

TABLE 14

Yam: calculated increase in farmers' price following rural road improvement

1978 August Kumasi price	=	¢ 467 (100 tubers)
Gross wholesaler and retailer margins at 33%	=	¢ 154.11 (100 tubers)
Combined transport and producer price	=	¢ 312.89 (100 tubers)

Regression of transport charge with distance

¢ = 16.37 + 0.0405 km R^2 = 0.21 F = 5.029 Sig. at 5%

21 observations

Average yam transport charge 24.33 Average distance 196.8 km

All items with 30 km of main road	Length of road improvement		
	5 km	20 km	50 km
1. Calculated transport charge ¢	17.78	18.39	19.60
2. Calculated producer price ¢	295.11	294.50	293.29
Calculated reduction in transport charge ¢ (and percentage increase in producer price)			
3. TRRL Option 1	0.01 (0.004%)	0.04 (0.02%)	0.11 (0.04%)
4. Scott Wilson Kirkpatrick Option 2	0.06 (0.02%)	0.26 (0.09%)	0.65 (0.22%)
5. TRRL Option 3	0.15 (0.05%)	0.42 (0.14%)	0.69 (0.24%)
6. Scott Wilson Kirkpatrick Option 4	1.1 (0.37%)	3.42 (1.16%)	5.7 (1.44%)
7. Average percentage increase in price of 4 options	(0.1%)	(0.4%)	(0.6%)

Combining the two estimates of the change in vehicle operating costs with the two alternative approaches in the treatment of standing charges, four estimates were made of the forecast change in transport charges that would result for each commodity and each length of road improvement considered. Detailed calculations using maize as an example for a 5 km road improvement are shown in Appendix 2.

7.3 *The increase in farmers' prices stemming from road improvement*

The overall percentage increases in farmers' prices due to road improvements are shown in Tables 13, 14 and 15. The results indicate that the increases in farmers' prices following improvements to feeder roads are likely to be minute, even on the assumption that *all* the benefits are passed on to the farmer.

The average of the 4 options considered shows an expected increase in farmers' prices to be in the order of 0.8 per cent for a 50 km improvement in a feeder road for maize. The figures for yam and plantain are 0.6 per cent and 0.5 per cent respectively.

7.4 *The change in farmers' prices following the conversion of a footpath to a passable vehicle track*

The survey found that the average charge to a farmer for moving one headload of produce from farm to village was ¢ 0.7 per km. However a majority of households preferred to use domestic labour for this purpose,

TABLE 15

Plantain: calculated increase in farmers' price following road improvement

1978 August plantain price = ₵ 14.5 per bunch
Gross wholesaler and retailer margins at 33% = ₵ 4.785 per bunch
Combined transport and producer price = ₵ 9.715 (₵ 1068.65 per seat)

Regression of transport charges with distance per seat (1 seat = 110 bunches)

₵ = 49.21 + 0.0607 km R^2 = 0.11 F = 2.724 Not Sig.
24 observations

Average plantain transport charge is ₵ 56.4 (per seat) Average distance 118.6 km

All items with 30 km of main road	Length of road improvements		
	5 km	20 km	50 km
1. Calculated transport charge ₵	51.33	52.24	54.06
2. Calculated producer price ₵	1017.32	1016.41	1014.59
Calculated reduction in transport charge ₵ (and percentage increase in producer price)			
3. TRRL Option 1	0.017 (0.002%)	0.067 (0.007%)	0.17 (0.017%)
4. Scott Wilson Kirkpatrick Option 2	0.01 (0.01%)	0.38 (0.038%)	0.96 (0.095%)
5. TRRL Option 3	0.43 (0.042%)	1.2 (0.12%)	1.9 (0.19%)
6. Scott Wilson Kirkpatrick Option 4	3.18 (0.31%)	9.7 (0.95%)	15.7 (1.55%)
7. Average percentage increase in price of 4 options	(0.09%)	(0.28%)	(0.46%)

although a very sizable minority did hire labour for headloading when necessary. In the following calculations it is assumed that moving each headload of produce by one kilometre 'costs' the farmer ₵ 0.5 per kilometre.

A large bag of maize (220 lb) is much heavier than an average headload. Assuming it to be equivalent to 2.5 headloads the cost of headloading it will be ₵ 1.25 per kilometre.

If it is assumed that the produce will be bought by a wholesaler at the terminus of the road and that the farmer is responsible for bringing produce to the terminus then the extra road transport costs of moving produce further by road need to be calculated using wholesaler transport costs.

Using the wholesale transport charge-distance regression relationship for maize shown in Table 9, the cost of moving one bag of maize 30 kms from Kumasi is ₵ 1.56. The estimated combined transport and producer price for maize sold in Kumasi in August 1978 mentioned in Table 13 is ₵ 60.97. Hence the farmers' price offered at the roadside 30 kms distance from Kumasi is estimated to be ₵ 60.97 less ₵ 1.56, ie ₵ 59.41.

If the farmer headloads the maize from his village to the roadside, a distance of 5 km, then his headloading costs, per bag of maize, will be:

5 x ₵ 1.25 = ₵ 6.25

This will give the farmer a farm gate price (ie. after transport costs have been deducted) of ₵ 53.16.

If on the other hand vehicle access is provided then the additional transport charges can be calculated to be ₵0.18 for the additional 5 kms of vehicle transport. This is calculated from the slope component of the regression of wholesale transport charges shown in Table 9. Hence by bringing vehicle access 5 km closer to the farmer, we may expect the farmer to be better off by an amount equal to the difference of the two transport charges, ie. by ₵6.07 per bag of maize. This amount is 11.4 per cent of the farmer's original farm gate price. Similarly it may be calculated that by bringing vehicle access 2 km closer or 20 km closer to the farmer then farm gate prices would rise by 4.3 per cent or 70.6 per cent respectively.

These increases in producer maize prices compare with a calculated increase of 0.08 per cent for a 5 km improvement and a 0.29 per cent increase for a 20 km improvement in road surface from earth to gravel.

The calculations (which are admittedly, only approximations) suggest that replacing a footpath between a village and the road head by a vehicle track may benefit the farmer through an increase in farm gate prices by some two orders of magnitude compared with improving the same length of poor quality road surface to a good quality gravel road. In other words, from the point of view of agricultural production, vehicle access for aggregated loads is all-important. Once access is achieved, reductions in vehicle operating costs by improving the road are considerably less important.

In making the case for road investment, agricultural benefits need to be carefully weighed against construction and maintenance costs and non-agricultural traffic benefits. It would be uneconomic to supply every small farm with its own vehicle access because of the high initial construction costs; and, given sufficiently high traffic levels, the improvement of existing rural roads will be justified on the basis of changes in vehicle operating costs alone.

8. TRANSPORT CHARGES AS A CONTRIBUTORY FACTOR IN THE VARIABILITY OF MARKET PRICES IN ASHANTI REGION

An analysis of the recorded Ministry of Agriculture monthly market prices in the main District Centres of Ashanti demonstrates considerable variations in prices between markets at the same time. For example, Table 16 shows that in August, the prices of plantain, cocoyam and tomatoes varied by more than two to one in the different district markets.

The largest range in prices was for cassava in October when the price at Bekwai was reported to be 6 times the price at Nkenkasu. A number of factors can contribute to the wide range of prices. High transport costs, small commodity volumes, poor information on variation in retailing costs, perishable commodities and a monopolistic marketing system are likely to be amongst the principal reasons. However, an examination of the likely transport charges reveals that they probably contribute to only a relatively small component of the variation in prices.

Using the regressions shown in Table 9 an estimate was made of likely transport charges involved in moving produce from the lowest priced market to the highest priced market shown in Table 16, and the results are shown in Table 17. In these cases transport charges accounted for an average of only 7.2 per cent of the price difference for maize, 4.3 per cent for plantain and 19 per cent for yam.

The transport charges used to calculate these figures were based on data collected at the major markets in Kumasi and it is possible that higher charges would be the norm for transport between two relatively smaller

TABLE 16

Retail market prices of agricultural commodities in 16 district centres of Ashanti Region

	August	September	October
Maize (220 lb bag)			
No. of markets	14	12	14
Mean price ¢	75.33	81.13	71.57
Standard deviation	13.40	15.4	12.7
Max. price ¢	95.00 (Anyinamoso)	120.0 (Obuasi)	93.33 (Obuasi)
Min. price ¢	51.33 (Agona)	56.0 (Agona)	58.00 (Agona)
Plantain (20–25 lb bunch)			
No. of markets	15	16	16
Mean price ¢	15.85	13.57	10.48
Standard deviation ¢	4.0	3.4	2.4
Max. price ¢	22.5 (Effiduase)	18.62 (Mampong)	17.20 (Fumso)
Min. price ¢	8.83 (Agona)	7.00 (Konongo)	7.75 (Abofour)
Yam (100 tubers)			
No. of markets	3	3	3
Mean price ¢	476.67	373.33	349.08
Standard deviation ¢	39.4	67.0	50.8
Max. price ¢	520.0 (Ejura)	447.0 (Kumasi)	406.25 (Kumasi)
Min. price ¢	443.0 (Mampong)	316.0 (Ejura)	307.0 (Mampong)
Cassava (200 lb bag)			
No. of markets	9	6	10
Mean price ¢	41.09	37.70	38.85
Standard deviation ¢	5.72	13.6	14.2
Max. price ¢	52.0 (Effiduase)	55.0 (Obuasi)	84.0 (Bekwai)
Min. price ¢	32.0 (Mampong)	21.0 (Fumso)	14.0 (Nkenkasu)
Cocoyam (200 lb bag)			
No. of markets	6	2	8
Mean price ¢	77.33	90.0	102.29
Standard deviation ¢	20.9	14.1	24.4
Max. price ¢	100.0 (Fumso)	100.0 (Obuasi)	163.33 (Kumasi)
Min. price ¢	40.0 (Abofour)	80.0 (Anyinamoso)	62.5 (Mampong)
Tomatoes (Average basket)			
No. of markets ¢	11	6	9
Mean price ¢	29.74	43.0	56.19
Standard deviation ¢	10.4	14.1	29.5
Max. price ¢	51.5 (Obuasi)	62.0 (Konongo)	115.0 (Bekwai)
Min. price ¢	20.0 (Bekwai/Ejura)	25.0 (Effiduase)	24.48 (Adagama)

TABLE 17

Transport charges as a proportion of the difference between minimum and maximum district retail prices

Commodity	Markets with maximum and minimum prices	Price difference between markets ¢	Distance between markets km	Calculated transport charge ¢	Transport charge as a percentage of difference
Maize Large bag	Anyinamoso-Agona (August)	43.47	60	2.64	6.0%
	Obuasi-Agona (September)	64	87	3.61	5.6%
	Obuasi-Agona (October)	35.33	87	3.61	10.2%
Plantain 1 seat (110 bunches)	Effiduase-Agona (August)	1503.7	17	50.24	3.3%
	Mampong-Konongo (September)	1278.2	73	53.64	4.2%
	Fumso-Abofour (October)	1039.5	130	57.10	5.5%
Yam 100 tubers	Ejura-Mampong (August)	77	38	17.9	23.2%
	Kumasi-Ejura (September)	131	89	20.0	15.3%
	Kumasi-Mampong (October)	99.25	50	18.4	18.5%

district centres; however even if the transport charges were doubled the conclusions would not be substantially different.

Overall, it appears that little arbitration takes place between the markets and the figures confirm that other factors besides transport charges (such as poor information and a monopolistic marketing structure) are the major determinants of price variation within the region. Again the analysis suggests that variation in transport costs induced by change in the quality of road running surface would have only a very small impact on the price spread of major commodities in the Region.

9. DISCUSSION

The principal means of transport of produce from farm to village is headload. The small sizes of the farms, the small volumes of produce to be moved and the small distances involved make it impractical to use any other form of transport at this stage, but there may be scope in the future for the larger farmers to make use of tractors and trailers for this purpose should they become more readily available.

On the whole, farmers take only a small proportion of their produce to major markets in the Region; the bulk of their produce is sold at home or at the local village market. The survey provides little evidence to suggest that accessibility promotes greater sales of farm produce within the range of accessibility considered. The more inaccessible farms appear to sell more cocoa, maize and plantain although the more accessible ones do appear to sell more cassava.

Marketing in Ashanti Region is dominated by a large number of traders who are able to operate in a restrictive fashion. With varying degrees of success they can divide up and control the purchasing of produce from farmers, control the volumes of produce and prices entering urban markets and enforce minimum retail price levels. The limits to their monopoly power are determined by the ability of farmers to bypass the marketing system. Wholesale traders make a living by making use of the economies of scale of transporting produce in bulk and by the fact that transporters operate price discrimination against the individual farmer who takes small loads to market.

In order to promote more food production for sale and to help the less well off farmer there is scope in trying to implement a policy which encouraged transporters to charge much less (relative to passenger fares) for individual loads of food produce. The evidence points to very high profits on this component of their traffic. This measure would strengthen the farmers bargaining power with the travelling wholesalers and thus increase revenue to the farmer.

A considerable range of prices has been found to exist at the same time in the different district centres of the Region. Transport charges do not appear to be a major factor contributing to this state of affairs. The divergence in prices is probably due to poor information and the exercise of monopoly power by the marketing system. A more competitive marketing system may be brought about by measures such as the provision of working telephones at market centres, price information broadcast by radio and newspaper and the provision of more space at markets and lorry parks for the less institutionalised farmers and market traders to sell their produce.

The survey found very little evidence of rotten farm produce having been caused by impassable roads in the Region. It is possible that elsewhere in the country (in the flatter and some of the wetter areas where vehicles could get bogged down more easily) impassable roads could be a more important issue.

From the point of view of agricultural production, vehicle access for aggregated loads is all-important. Once access is achieved, reductions in VOC by improving the road are considerably less important. Thus access to all villages and settlements as distinct from improvements to road alignment and the quality of the road surface, becomes a priority for transport planning. This basic access has then to be maintained; for tracks with very low traffic levels investment in bridging, minor drainage work and other small scale remedial measures probably represents the best use of scarce resources.

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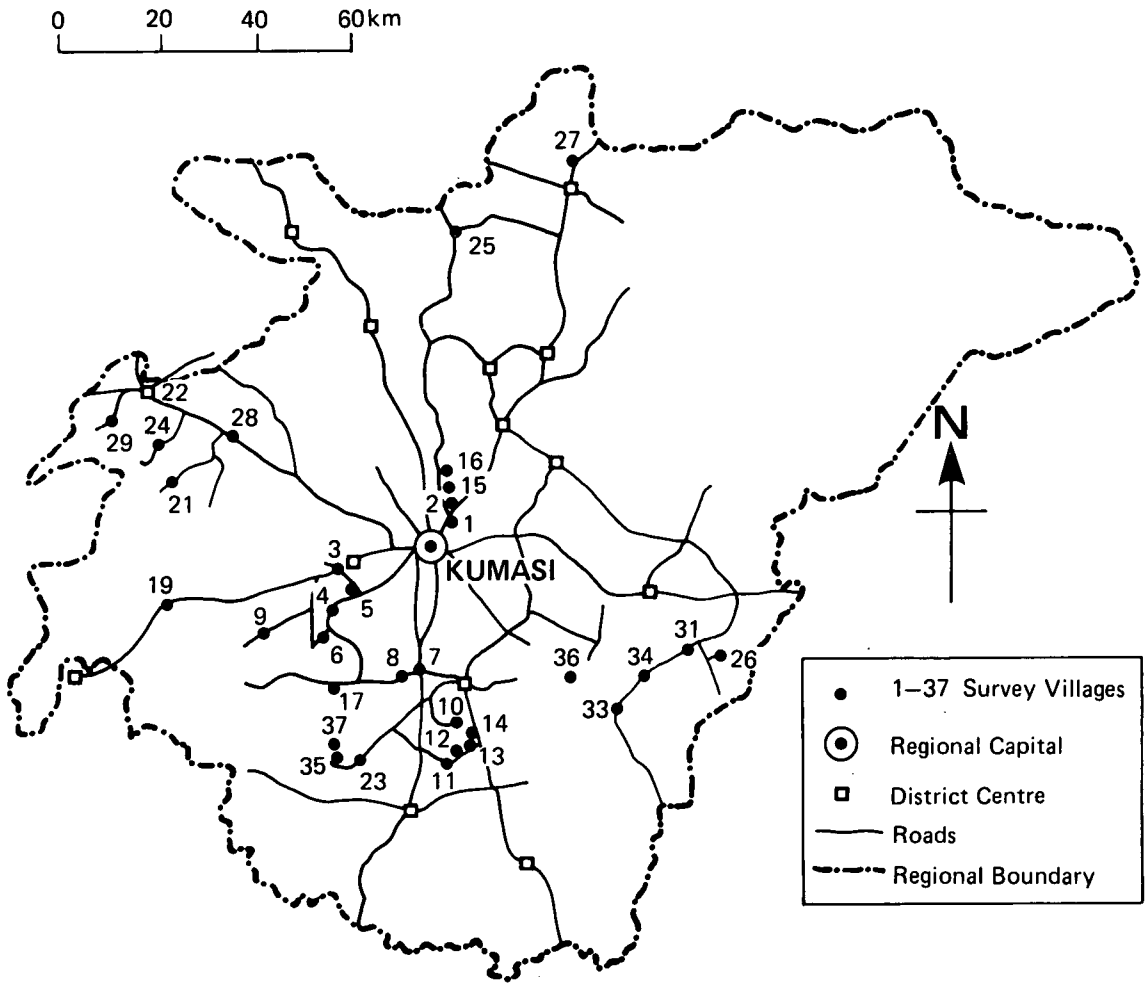

Fig. 1 A map of Ashanti Region showing location of survey villages

12. APPENDIX 1

LIST OF SURVEY VILLAGES

Zone	Village No.	Village name	No. of holders	Distance to Kumasi km
Zone 1				
Far West	19	Nynahin	12	59
Zone 2	3	Toase	10	25
Near West	4	Koben	8	35
	5	Mpasatia	28	29
	6	Winiso-Sekyikrom	26	45
	9	Mpatoam	18	48
		Zone 2		37
Zone 3A	7	Ania Nkwanta	3	31
Near South	8	Huntado	14	36
	10	Kenseie	17	49
	11	Akrokerri	12	51
	12	Brobriasi	13	52
	13	Kyenaboso	5	53
	14	Edubisi	9	54
		Zone 3A		48
Zone 3B	17	Chechewere	7	53
Far South	8	Kente	8	71
	35	Ntebene	1	73
	36	Kokoben	13	69
	37	Obenebeng	9	76
		Zone 3B		68
Zone 4	26	Kyempo	15	90
North West	31	Odubi	9	82
	33	Ofoase	30	102
	34	Dwendwenase	22	96
		Zone 4		96
Zone 5	1	Pankrono	29	8
Near North	2	Atimitim	8	9
	15	Maase	7	13
	16	Edjunase	5	14
		Zone 5		10
Zone 6	21	Mpasaso	22	74
North West	22	Tepa	27	72
	24	Abonsuaso	35	89
	28	Hwibaa	17	54
	29	Nyamebekyere	6	89
		Zone 6		76
Zone 7	25	Sekodumasi	20	77
Far North	27	Dromankuma	26	84
		Zone 7		81

13. APPENDIX 2

FOUR ALTERNATIVE WAYS OF CALCULATING THE REDUCTION IN TRANSPORT CHARGES FOLLOWING ROAD INVESTMENT

13.1 *Sources of information on changes in vehicle operating costs*

(i) TRRL (LR 723, Tables 10 and 12). For light goods vehicle.

Costs at 6000 mm roughness (gravel road)	0.233 £ per km
Costs at 8000 mm roughness (earth road)	0.247 £ per km

This is equivalent to 5.6 per cent change in costs between earth and gravel surfaces.

(ii) Scott Wilson Kirkpatrick (Road Vehicle Operating Cost Manual, Ghana Highway Authority, 1975, Table 2.11). For mammy wagon.

Costs for gravel surfaced road at 40 mph	₵0.144 per km
Costs for earth road at 20 mph	₵0.211 per km

This is equivalent to a 32 per cent change in costs between earth and gravel surfaces.

13.2 *Changes in transport charges using the regression slope of Kumasi market produce transport charges (Options 1 and 2)*

Option 1 (using TRRL data) and Option 2 (using Scott Wilson Kirkpatrick data) are calculated from the slope component of the regressions of wholesale produce transport charges.

The wholesale market transport charge for a large bag of maize was found by regression analysis to be as follows:

Transport charge ₵ = 0.485 + 0.036 km

Hence the calculated reduction in transport charges for a bag of maize with improving 5 km earth road to gravel road may be found thus:

(i) Option 1 (TRRL)

0.056 x 0.036 x 5 = ₵0.01

(ii) Option 2 (Scott Wilson Kirkpatrick)

0.32 x 0.036 x 5 = ₵0.057

13.3 *Changes in transport charges based on the proportionate change in total transport costs*

Option 3 (using TRRL data) and Option 4 (using Scott Wilson Kirkpatrick data) are calculated using estimates of the proportionate change in total transport costs. Transport charges are assumed to reflect total vehicle operating costs when expressed in a per kilometre form. No allowance is made to separate out overhead costs of loading and unloading costs which may be expected not to vary with journey distance. As a result it may be felt that using these two approaches the estimated total change in transport charges stemming from a road improvement is somewhat overestimated.

13.3.1 *The proportionate change in transport charges.* The assumption is made that a 5 km earth road is to be improved to gravel surfaced road; in addition it is assumed that the produce must travel a further 30 km on a gravel surfaced road to Kumasi. The state of the latter road will remain unchanged for the analysis.

(i) Option 3 (TRRL)

Transport costs 5 km earth road = £0.247 x 5
= £1.235

Transport costs 5 km gravel surfaced road = £0.233 x 5
= £1.165

Transport costs 30 km gravel road = £0.233 x 30
= £6.99

∴ percentage change in total transport costs for 5 km improvement

$$= \frac{1.235 - 1.165}{6.99 + 1.235} \times 100$$

= 0.85 per cent

(ii) Option 4 (Scott Wilson Kirkpatrick)

Transport costs 5 km earth road = ₵0.211 x 5
= ₵1.055

Transport costs 5 km gravel road = ₵0.144 x 5
= ₵0.72

Transport costs 30 km gravel road = ₵0.144 x 30
= ₵4.32

∴ percentage change in total transport costs for 5 km improvement

$$= \frac{1.055 - 0.72}{4.32 + 1.055} \times 100$$

= 6.2 per cent

13.3.2 *The absolute change in transport charges for Options 3 and 4.* The wholesale transport charge for maize was found by regression analysis to be:

Transport charge ₵ = 0.485 + 0.036 km

Hence total transport charge per bag of maize to the village for (30 + 5) km will be ₵1.745. The calculated reduction in transport charges for a 5 km improvement may be calculated as follows:

(i) Option 3 (using TRRL data)

= 0.85% x ₵1.745

= ₵0.015

(ii) Option 4 (using Scott Wilson Kirkpatrick data)

= 0.062 x ₵1.745

= ₵0.108

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The study found that improvements of the surfaces of existing roads would have only a negligible impact on prices paid to the farmer. However, replacing a footpath by a vehicle track may have a beneficial impact to the farmer of some one hundred times more than improving the same length of a poor quality road surface to a good quality gravel road. Little evidence was found of a loss of produce through roads becoming impassable to vehicle traffic.

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