

The Rural Transport Infrastructure and Marketing Linkage within the Context of the Sub-Regional Zambia-Malawi-Mozambique Growth Triangle.

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Panel Session: Making new connections: Mobilities, roads and rural access in sub-Saharan Africa.

Organised by African Community Access Programme (AFCAP)

8th September 2012,

University of Leeds

ASAUK Conference 2012

Overview

- This paper investigates *how **the reductions in the cost of movement** has affected economic activities in Zambia's Chipata and Lundazi districts.*
- The aim is to *evaluate the long-term direct benefits of the EPFRP carried out from 1996 to 2001 by investigating whether **the accessibility improvements** have translated into increased marketing activities.*
- **The identification strategy** relies on discrete choice Logit model approach using data from our own firm level survey.
- *We find at **the district level** that the improved accessibility from the rural road improvements could have contributed to:*
 - *Small-scale private companies being more likely to have **moved into** these two districts*
 - *'small-scale private companies' engaged in 'agricultural marketing' had made **a positive relocation decision.***

"To end poverty, build a road"
A Chinese saying.



President Sata's speech roadmap for Zambia's development

- 14th October 2011: Zambia's Parliament opens as Newly Elected **President Sata spells out his growth plans** for Zambia.
- President Sata cited that **infrastructure development** as one of the sectors that are **vital to the realization of sustainable economic development** in Zambia.
- Recognition of poor infrastructure led to **increased levels of hunger and poverty** among the people in **rural areas**.
- Therefore the New Zambian Government aims encourage **investment in infrastructure development**.

SIXTH NATIONAL DEVELOPMENT PLAN 2011-2015

“Sustained economic growth and poverty reduction”

- The SNDP focuses on development **strategies that address poverty**, by ensuring that minimum requirements including **access roads** are in place.
- In order to **reduce the high poverty levels in the rural areas** and promote rural development, focus will be on:
 - stimulating agriculture productivity and
 - **promotion of agro-businesses,**
 - improving the **provision of basic services** such as transportation, extension services.
- In addition, investments in key economic infrastructure such as **feeder roads** will be undertaken.

Introduction

- *Trade policy* has been a dominant element in determining the pattern of Zambia's modern export-led economic growth.
- In addition to active participation in multilateral trade, *regional markets* also provide outlets for Zambian goods and services.
- *Zambia-Malawi-Mozambique-Growth Triangle (ZMM-GT)* countries' poor performance in the *international market place* can be attributed to a number of factors...
- Evidence suggest that *the poor state and inadequacy of the transport facilities and services* impacted on their performance.
- It is therefore appropriate, to assess *the role and relevance of the transport sector*.
- *Transportation costs* are a major part of total costs, affecting especially small firms and the entry of new firms into an industry or market.

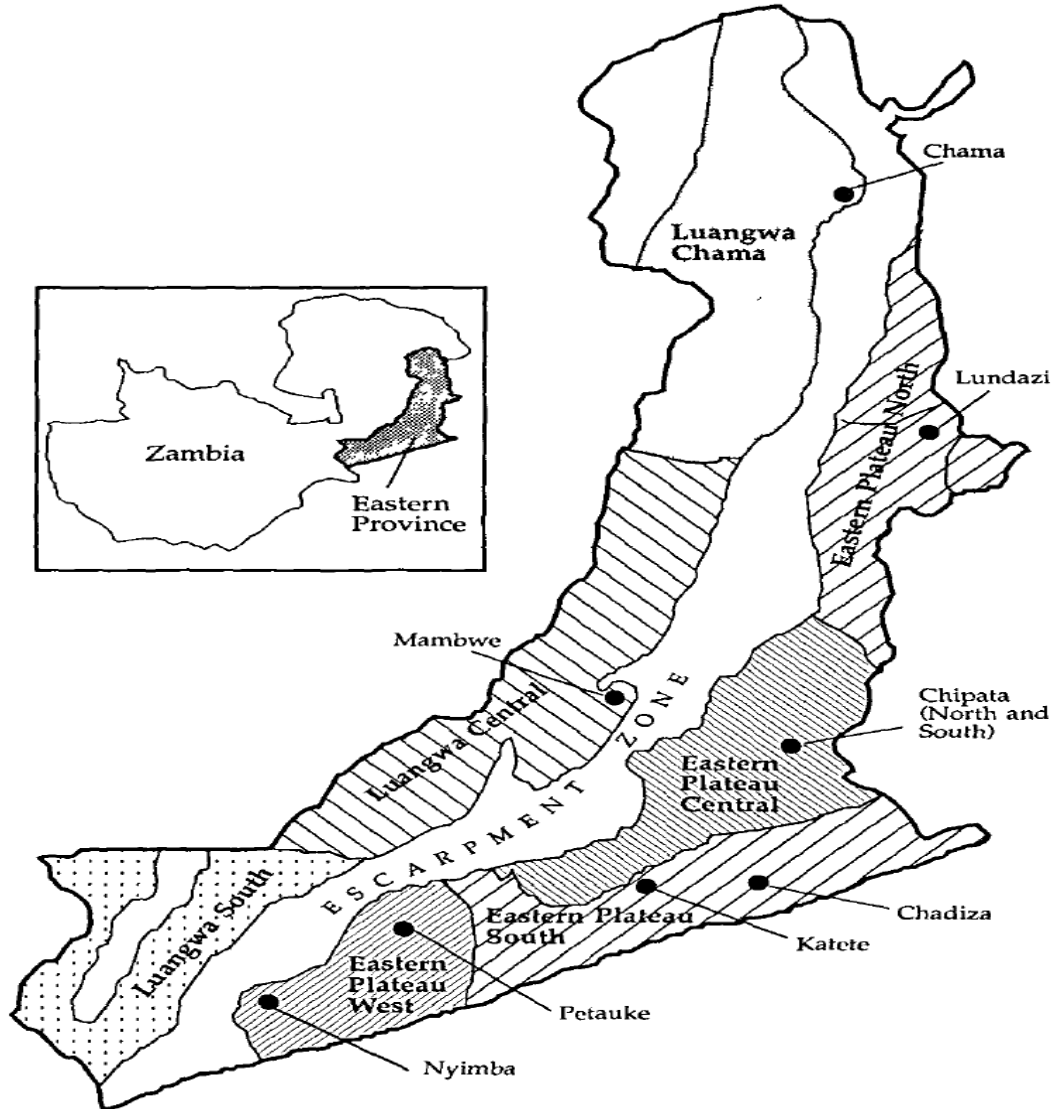
Hypothesis & Objective

- The geographical movements of firms, together with firm formation and expansion, decline and closure, influence *the geographical distribution of economic activity*.
- **The objective of our paper:**
- One topic that needs more attention is the study of **firm mobility** on *the local scale*. Thus, we explore the effects of these factors (i.e. determinants of firm migration) on *the decision to relocate* to Eastern Province
- **The key questions:**
 - Did the improvement of the feeder roads from 1996 to 2001 reduce the marketing costs?
 - Is *the expansion of trade* in Eastern Province the result of implementation of rural transport infrastructure development projects such as the EPFRP?
 - What policies/measures could be taken by the low-income countries themselves?

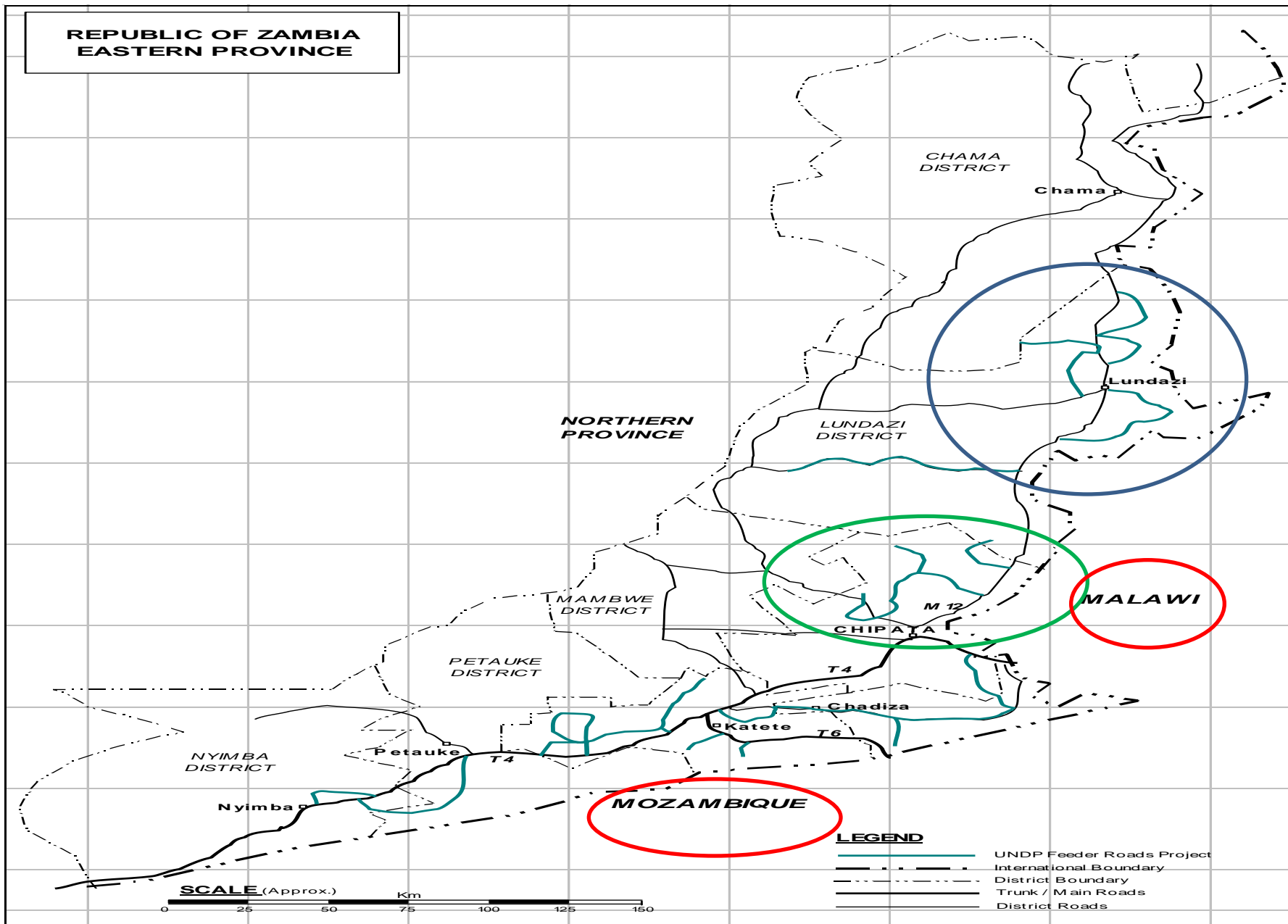
Outline of Presentation

- Brief background on the motivations behind the ZMM-GT initiative.
- Presentation our framework.
- Data:
 - Identification of the Users of EPFRP
 - Presentation of the Most Relevant Cash Crops in Chipata and Lundazi districts
- Impact of SADC on the market participants and that of the ZMM-GT.
- Conclusion and Policy recommendations.

Agro-ecological zones and agricultural districts, Eastern Province, Zambia



The Eastern Province Feeder Road Project



Eastern Province Road Sector Network, (km)

- Table 1: Eastern Province Road Sector Network, (km)

i.	ii.	iii.	iv.	v.	vi.
Trunk	Main	District	Feeder (*)	(Primary Feeder)	Total (i+ii+iii+iv)
415	179	1,516	3,862	-2,359	5,972

Table 2: Eastern Province Feeder Road Network

		Km	Total KM	Percentage of total feeder road network	Percentage of primary feeder road network
EPFRP	Rehabilitated Roads	21			
	Rehabilitated and Maintaned Roads	383	404	$404/3,862 = 10\%$	$404/2,359 = 17\%$
Enhanced Maintenance Roads		429		$429/3,862 = 11\%$	$429/2,359 = 18\%$
Total Maintained Road		833		$833/3862 = 22\%$	$833/2,359 = 35\%$

Background: Sub-Regional Zambia-Malawi-Mozambique Growth Triangle

- *Growth Triangles* are transnational economic zones spread over geographically neighbouring areas, in which differences in factor endowments of three or more countries are exploited to promote external trade and investment .
- UNDP Resident Representative in Zambia, Ms. King-Akerele, through her experience in Asia had witnessed the successful *growth triangles in South East Asia*. It was because of that experience that she in 1999 had decided to see whether growth triangles could be *replicated successfully in Southern Africa*.
- *The strategic objective is to complement and further enhance national efforts* at economic development, particularly of the somewhat marginalized and economically depressed areas that constitute much of the economic space of the proposed ZMM-GT.
- *The area of coverage of the Growth Triangle* comprises some 301,000 square kilometers and includes: **Eastern and Northern Provinces of Zambia**, Central and Northern Regions of Malawi, & Tete Province in Mozambique.

Framework

- Outline **Conceptual framework** to test the hypothesis:
 - that transport infrastructure investments in the rural areas of Zambia's Eastern Province promote agricultural trade through *operation* decision-making by startups and *relocation* decision-making by existing firms.
- Rural transport infrastructure investments directly increase *the connectivity* between the district centres and/or the rural areas in the hinterland of the centres.
- Present the **methodological framework** within which the analysis of this paper will take place.
- In response to *improvements in accessibility* from infrastructure investment firms can e.g. increase:
 - their demand for infrastructure facilities (trip generation effect).
 - their choice of travel mode and their travel route (i.e. the modal split and trip assignment effects).
 - They may *relocate* (i.e. the spatial location effect), or
 - They may adopt all of these options.
- Each of these effects will influence *the degree of use of transport*.

Location theory: Explaining the firm relocation process

- The *land use transport links* were included in Von Thunen's classic (1826) study on impact that transport has on patterns of Agr. Dev.
- Changes in the costs of transport will influence the distribution of activities through the land market it was claimed.
- Christaller(1933) *central place theory* proposed that the improvement of transport infrastructure strengthened the accessibility and dominance of the central city.
- *The industrial location theory* focuses on location factors determining the attractiveness of a site for firm location (*pull factors*).
- *Relocation theory* also takes into account the 'push out' of the present location (*push factors*).
- The *neo-classical location* theory focuses on the premise of the rationale firm that maximises profit in choosing the optimal location.
- The main forces driving firm relocation:
 - Transportation;
 - labour costs.
- the *behavioural location theory* replaces this picture of the firm by claiming that decision-makers act without perfect knowledge and settle for sub-optimum

Business Survey Methodologies

- Evidence to support the arguments: *Surveys of firms* about their intentions to *expand or relocate* as a result of a new transport link.
- Aim: The study aims at identifying the characteristics of the traders, assessing the constraints they face .
- We consider how *the reductions in the cost* of movement has affected the economic activities of producers, millers and traders in 2 districts.
- We use a study by Chiwele, Muyatwa-Sipula et al. (1998) as baseline.

1996 Baseline Survey Methodology

- Starting point of the baseline study was the recognition that little was known about the factors that influence the capacity and willingness of private traders in Zambia to *enter into the (remote) markets*.
- Study objectives: Answers to questions about *the nature of the market networks* that had emerged – e.g. the way various players in the market (producers, traders and millers) relate to each other for storage, finance and transport.
- The Chiwele et al. 1998 study combines both:
 - questionnaire surveys (fieldwork e.g. in Zambia's Eastern Province)
 - qualitative methods (group discussions with traders)
- Two approaches were used to *survey the traders*.
- Chiwele et al. conducted their fieldwork from 3 August 1996 to 24 August 1996.
- There were four checklists targeted at key informants, farmers and traders.

2005 Follow-up Business Survey Methodology

- In our overall quest to evaluate **the long-term direct benefits** of the EPFRP, in the 2005 follow-up study we investigate whether the accessibility improvements have translated into increased marketing activities.
- Fifty questionnaire interviews were carried out from August to September 2005 in respectively Chipata and Lundazi's urban district centres, after we had listed all the relevant organizations in those two areas.
- The focus of the interview was e.g. on:
 - Vehicle operations costs and travel issues;
 - socio-economic and stimulus issues;
 - firm migration issues including decision to operate in, relocate to, expand activities in, and stay;
 - travel and economic improvement issues;
 - business environment issues etc.

Identification of Geographical Movement of Firms due to the EPFRP

- Analyse & discuss *business migration* event based on our 2005 survey.
- A firm chooses a location from a number of alternatives taking economic and/or non-economic factors into account.
- Mobility characteristics of firms can be used as dimensions for categorising all firms in groups with similar *mobility profiles*.
- Our approach assumes that these mobility profiles are at least to some extent of influence on *the location preferences of a firm*.

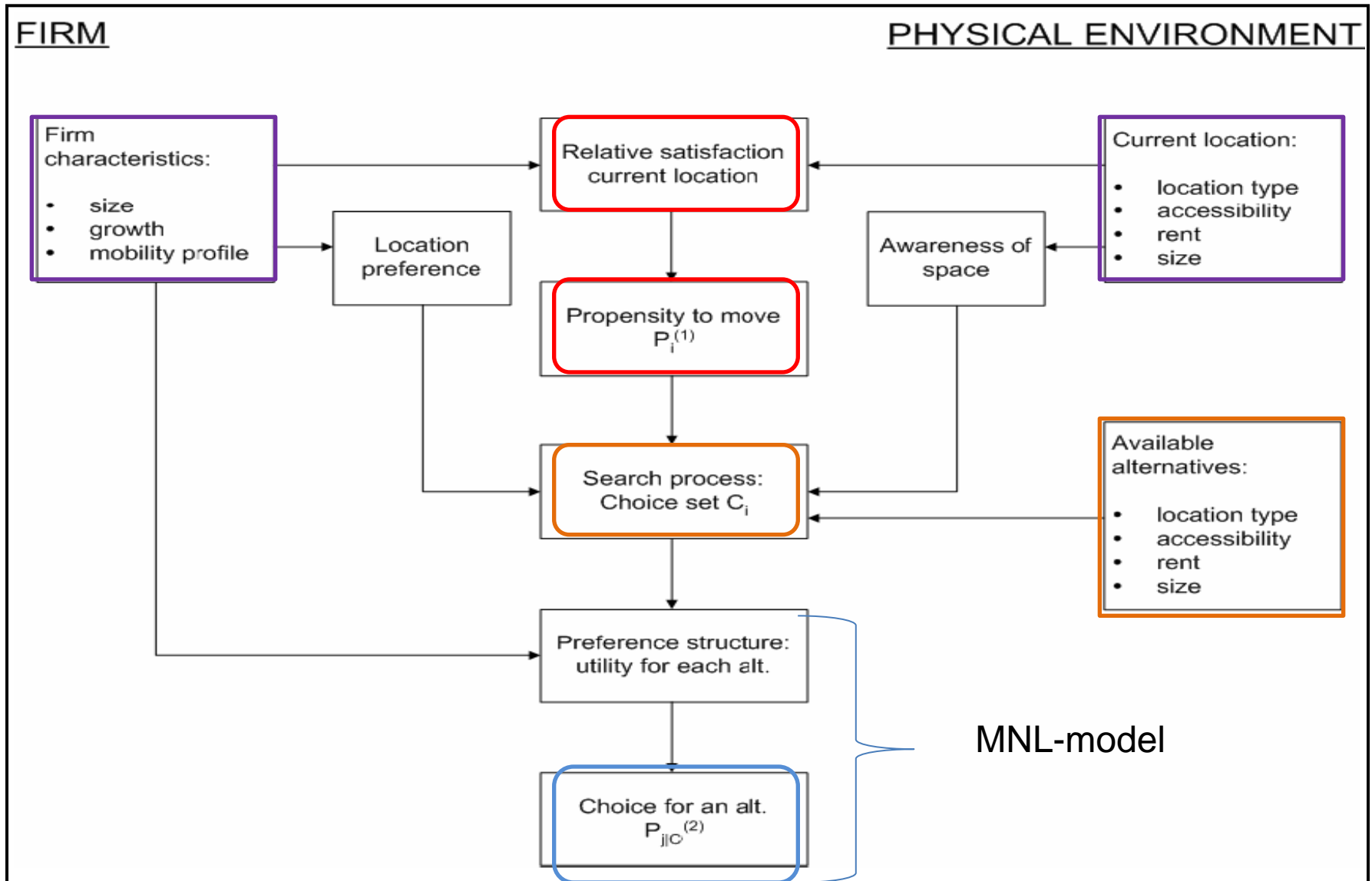
Table 4.1: Mobility profiles in Chipata and Lundazi Districts, 2005

		Main Activity						Mode of Transport for Daily Travel Activities and Operations							
Mobility Profile		Agricultural Trade / Marketing	Agricultural / Rural Development Project	Agricultural Processing	Transport of Agricultural Produce / Inputs	Agro-Industry (food, beverages etc.)	Other	Landrover	Passenger Car (personal vehicle)	Motorbike	Pickups (van)	small (mini-) bus	Tractor	Medium-to Heavy Truck	Bus (Coach)
1	Private Company	74%	4%	9%	0%	13%	0%	35%	74%	35%	70%	4%	9%	87%	9%
2	Individual Trader	100%	0%	0%	0%	0%	0%	20%	60%	40%	60%	20%	20%	80%	20%
3	Input Supplier	83%	0%	0%	17%	0%	0%	17%	33%	17%	50%	0%	0%	50%	17%
4	Miller	0%	0%	83%	0%	17%	0%	50%	50%	0%	50%	17%	0%	100%	0%
5	NGO	0%	100%	0%	0%	0%	0%	71%	14%	86%	71%	0%	14%	43%	0%
6	Other	0%	50%	0%	0%	0%	50%	50%	0%	0%	100%	0%	0%	100%	0%

Discrete Choice Model

- *'Discrete choice models'* explain a discrete choice or outcome.
- Our model is empirically tested on micro survey data for firms operating in respectively Chipata & Lundazi district centres in 2005.
- To accurately describe the behavioural context of *the location decision* an approach has been applied in which an individual firm
 - makes *a decision to relocate*;
 - chooses a unique location from a limited set of feasible alternatives.
- Furthermore it is acknowledged that firms have
 - a large variety in mobility characteristics and
 - a large variety in *location preferences* with regard to infrastructure.
- The theoretical model is based on *a behavioural approach* describing *the spatial decision making* of individual firms in a disaggregated physical environment.
- At a certain point in time this firm has various characteristics that determine their preferences, such as
 - its size (***Stratum_b***) or
 - its mobility profile (**Table 4.1**).

Figure 6.1: Conceptual model of an individual firm in a physical environment



Selection of 1996 Baseline Findings

- All the blocks had motorized feeder roads, which were passable during the dry season but were difficult to use during the rainy season.
- The situation appeared to deteriorate as one moved away from the centre of the districts.
- CSO's CFS established that 81 per cent of farm households in the country lived within 5 kms of a public road.
- Only 7.3 per cent lived more than 10 kms from a public road.
- *Transportation* appeared to be a major problem in 1996 for many traders, some of whom go to the area and buy grain and then wait for up to one week for transport to move their purchases.
- Observed that those areas with relatively well serviced roads tended to have *private transporters* who moved farmers' inputs and products and charge prices that many farmers were able to afford.
- Poorly maintained roads and the absence of storage facilities meant that the new agricultural marketing system marginalized rather than integrated those farmers located in remote areas.

Responses to the 1996 Base-line Questionnaire

- The major factors determining *choice of market* seemed according to Chiwele et al. to be the following:
 - the rate of turnover,
 - the non-existence of other markets,
 - lack of transport and
 - the proximity of the market.
- Most of the large-scale traders went into crop marketing *after 1992 when the market was liberalised*.
- Large-scale traders were largely businessmen who engaged in other business activity besides trade in agricultural commodities because of the need to *diversify their business activities*.
- It is apparent that ready access to transport was the most important constraint.
 - Only one trading firm, which had always operated *a transport company*, had its own transport.
 - All the other traders relied on *hired transport*.

2005 Follow-up Survey Findings

- 2005 cross-sectional Business Survey based on standardised questionnaire administered to the potential users of the EPFR Network
- Our sample only contains 50 observations.
- We restrict ourselves to the variables which were available for as large a part of our sample as possible.
- Focus on the stated preference of the firms with regard to migration.
- Firms were asked to indicate whether *'the EPFRP had a sufficient effect on the feeder road network to induce the organisation's decision to*
 - *'relocate to' (relocate)* (question 28.2) or
 - *'operate in' (operate)* (question 28.1);
 - to *'expand activities in' (expand)* (question 28.3) or
 - to *'stay' (retention)* (question 28.4)
- in Chipata/Lundazi districts *that may not have been considered?*
- The respondent could choose from the following two categories: 0 = Yes or 1 = No.
- Dependent variable **y = Migration** can take values 0 and 1.

Frequency of the propensity to migrate (Migration)

Y=Migration		Frequency	Percent	Cumulative Percent	Obs (Total)
Operate	Yes = 0	22	48,89	48,89	
	No = 1	23	51,11	100	45
Relocate	Yes = 0	10	23,81	23,81	
	No = 1	32	76,19	100	42
Expand	Yes = 0	42	87,5	87,5	
	No = 1	6	12,5	100	48
Retention	Yes = 0	19	45,24	45,24	
	No = 1	23	54,76	100	42

Explanatory Variables

- The goal of our paper is to find the explanatory variables that determine the stated probability of firm migration.
- According to economic theory a firm will move if the benefits of moving to another location exceed the costs in a certain period of time.
- we follow *van Dijk and Pellenbarg's* eclectic approach, which implies that both
 - variables reflecting *the costs of moving* as well
 - variables that reflect *the benefits* should be taken into account.
- In our approach we only look at *the outcome of this process*: The stated preference to move to another location.
- In principal there are three categories of explanatory variables:
 - Firm internal factors,
 - Location factors (site and situation),
 - Firm external factors.

Figure 6.2: Distribution of firms in the 2005 Business Survey dataset

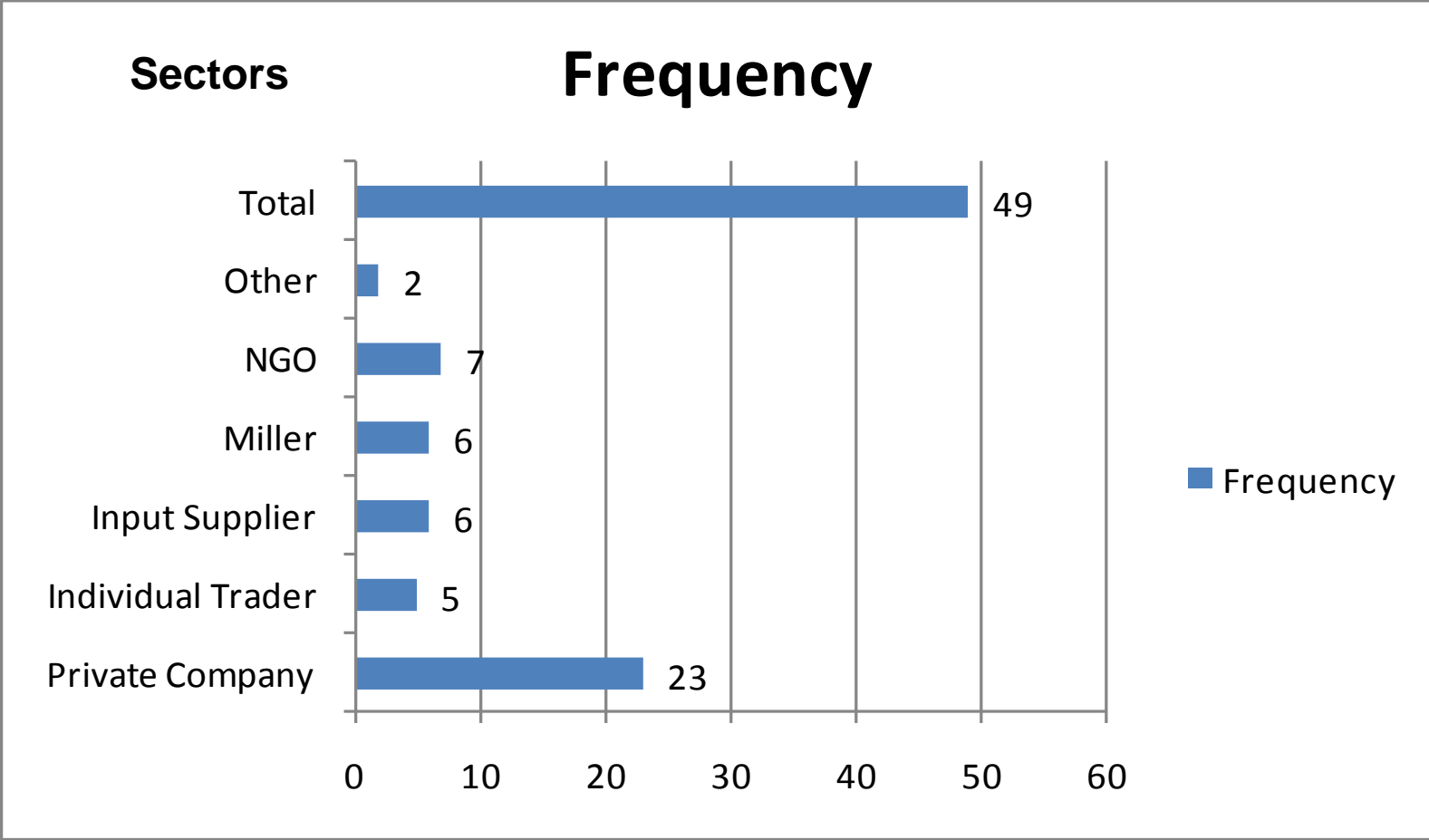


Table 6.6: Firm relocation by stratum, 2005

Strata	Mobility Profile	Number of observations	Relocated firms (%)	Number of observations	Start up firms (%)
1	Private Company	21	33%	21	43%
2	Individual Trader	4	0%	5	60%
3	Input Supplier	4	50%	6	50%
4	Miller	5	0%	5	60%
5	NGO	7	14%	6	33%
6	Other	1	0%	2	100%
Total	Total	42	24%	45	49%
	District				
33	Chipata	34	15%	34	53%
35	Lundazi	8	63%	11	36%
Total	Total	42	24%	45	49%

A Logit model

- Estimate an explanatory model for the stated preference of the firms with regard to *migration* (i.e. Question 28).
- Firms were asked to indicate *the decision* to: 'operate in'; 'relocate to'; 'expand activities in' and/or 'stay (retention)' in Chipata/Lundazi.
- With these two categories the dependent variable y (**migration**) can take the values 0 (=Yes) and 1 (=No).
- The decision to relocate activities is modeled within *a logit model* relating the probability to relocate to a set of explanatory variables X_i .
- *The probability of relocation* is $F(X'_i \beta)$, where F is the logistic distribution, which yields the *logit model*:
- (6.4)
$$\text{Prob}(y_i = 1) = F(X_i\beta) = \exp(X_i\beta)/[1+\exp(X_i\beta)],$$
- and β is the vector of coefficients.
- The choice of F returns a value between 0 and 1.
- The formulation of the model ensures that the predicted probabilities lie between 0 and 1.
- Use three conventional levels of significance: if $t > 1.66, 1.96$ or 2.33 the coefficients are significant at, respectively, the 10%, 5% or 1% level.

Table 6.8a-b: Empirical results

relocate	Coef.	Operate	Coef.
District	-1.214284* (.4939683)	District	.2598594 (.3719428)
Stratum	.3004319 (.2957639)	Stratum	-.0601546 (.202225)
stratumb	.3421194 (.5084106)	stratumb	.5461258 (.3558211)
mainacti	.1215341 (.3678684)	mainacti	-.263613 (.2497303)
_cons	40.30256 (16.20487)	_cons	-9.03512 (12.49195)
Number of obs.	41	Number of obs.	44
LR chi2(4)	8.97	LR chi2(4)	4.49
Prob > chi2	0.0619	Prob > chi2	0.3432
Log likelihood	-18.293651	Log likelihood	-28.205705
Pseudo R2	0.1968	Pseudo R2	0.0738

relocate	Coef.	Operate	Coef.
Chipata	-37.33617	Lundazi	-.5192594 (.9377194)
Private_Co~y	-19.2523*** (1.265691)	Private_Co~y	.4600117 (1.26952)
NGO	-44.61702	Individual~r	.6240815 (1.35689)
Small_scale	-17.8858*** (1.42214)	Miller	18.26497*** (2.34219)
Large_scale	-1.229367 (1.474231)	Small_scale	-18.79169*** (.9512165)
Agr_Trade	10.68342*** (1.265691)	Medium_scale	-18.25015
Agr_Industry	29.24257	Large_scale	-19.97427*** (1.071763)
_cons	35.16297 (2.00524)	Agr_Trade	-.4304713 (1.437127)
		Agr_Projects	-.2171959 (2.273725)
		Agr_Proces~g	-19.06374
		_cons	38.88029 (5.53137)
Number of obs.	29	Number of obs.	42
LR chi2(7)	19.20	LR chi2(10)	11.21
Prob > chi2	0.0076	Prob > chi2	0.3418
Log likelihood	-9.0801226	Log likelihood	-23.318896
Pseudo R2	0.5139	Pseudo R2	0.1937

Comparisons between the 1996 and the 2005 situation

- **1996** Chiwele et al., interviewed 48 traders,
 - nine of whom were classified as large traders while
 - the rest were *medium and small traders*.
- The picture that emerged in 1996 was one of an undeveloped market dominated by small and medium traders.
- **2005** Survey interviewed 50 organisations in the same two districts.
 - The majority (19) were small-scale (i.e. less than 5 employees).
 - The second most frequent stratum (16) was the large-scale organisations,
 - followed by twelve (12) medium-scale organisations
- Indicating a somewhat more developed market than in 1996.
- **Tobacco** and **Cotton** were not confronted with the same problems in **2005** as the food crops.
- Because of the rehabilitated feeder roads the private companies found it *easier to operate* in Eastern Province.
- Clark Cotton Zambia expressed an appreciation of the improvements made to the roads under the EPFRP.
- The EPFRP was successful.

Robustness Checks by Comparing Full with Reduced Logistic regression Models

Predictor	Variable Name	Relocation Decision										
		Variable	LOG1	LOG2	LOG3	LOG4	LOG5	LOG6	LOG7	LOG8	LOG9	LOG10(iii)
Categorical	Type of Organization	Stratum	1.41									1.35
Categorical	Size of Organization (Scales)	stratumb		1.04								1.41
dichotomous	(33=Chipata; 35=Lundazi)	District			0.32***						0.36*	0.30**
continuous	pctage decrease of cost of doing business	pctbusicost				0.97					0.99	
continuous	pctage increase in output	pctoutputi~r					1.02			1.02		
continuous	VOCs in past 12 months	VOC12months						1.00				
continuous	Adequate transportation	transporta~n							1.03			
Categorical	Main Economic Activity	mainacti										1.13
	Constant	Constant	1.51	2.87	1.05e+17***	11.54**	1.31	6.01**	2.83	1.31	5.23e+15**	3.19e+17**
		Number of Obs	42	41	42	37	37	23	42	37	37	41
		Log likelihood	-22	-22,8	-19,49	-19,27	-20	-11,31	-23,1	-20	-17,29	-18,29
		df_m	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	4.00
		chi2	2.04	0.01	7.13	2.51	1.13	5.65	0.01	1.13	6.47	8.97
		LR chi2(3)	7.16	8.96	2.07	(ii)	(ii)	(ii)	8.94	(ii)		
	Likelihood-ratio test	Prob > chi2	0.0670	0.0299	0.5581				0.0302			

7. Conclusions

- GoRZ expected that by the end of 1996 the new private-sector led marketing system initiated in 1992 would be able to stand on its own.
- Chiwele et al. (1998) showed that the new grain marketing system still was in transition and remained undeveloped at the end of 1996.
- *The nature of the infrastructure and the road network* in 1996 was one of the key constraints on the attainment of economic opportunities.
- Chiwele et al.'s examination of *the key players in the emerging marketing channels* showed that most had few facilities that enabled them to carry out their functions effectively.
- These findings lead us to conclude that an essential component in our understanding of the links between transport and economic integration must be *the microeconomic conceptualization of the processes at work in the location decisions of firms*.
- It was found that primarily small private companies are more likely to have moved into two districts as a consequence of the EPFRP.
- Mainly the 'small-scale private companies' engaged in 'agricultural marketing' had made a positive relocation decision.