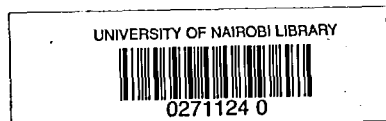


W DEMAND FOR NEW AUTOMOBILE IN KENYA 4

By

Bethuel Kinyanjui Kinuthia



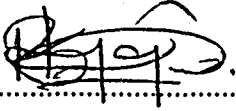
EAST AFRICANA COLLECTION

Research paper submitted to the Department of Economics in partial fulfillment of the requirements for the degree of Master of Arts in Economics

September, 2002

DECLARATION

This Research Paper is my original work and has not been presented for a degree in another university

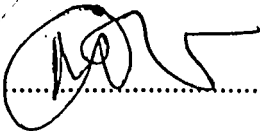


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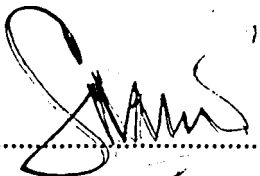
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LIST OF ABBREVIATIONS

AA	Automobile Association of Kenya
KMI	Kenya Motor Industry
GDP	Gross Domestic Product.
OECD	Organization of Economic Co-operation and Development
OLS	Ordinary Least Square
UN	United Nations
US	United States of America

ABSTRACT

The automobile industry is an important sector in many modern economies. It plays a key role in creation on employment, a major factor in the balance of payments in the producing country to mention but a few.

Automobile ownership is now on the increase due to its many uses and might soon fall in the category of a necessity. A majority of Kenyans rely on automobile for their day to day activities ranging from commuting to work to small business operations. In Kenya this sector has been threatened due to a number of factors. The aim of this study is to identify the determinants of demand for new automobile in Kenya and policy implications.

The parameters of the model were estimated using time series data for the period 1970-2000. The determinants discussed in this paper were tested in a model and their significance tested. The results of this study indicate that demand for new cars is determined by personal disposable income, Stock of automobile, import prices of cars, cost of credit and import duty.

Most of the variables were found to be consistent with theory. Those that were not had convincing reasons to support them. For any meaningful policies the government and other stakeholders in this sector need to consider these factors seriously.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The automobile industry is a central sector in Kenya today mainly because it provides gainful employment to our citizens. Through the sale of new vehicles in the domestic market in Kenya, the industry is able to achieve its production, profit and employment targets. When sales targets are not realized, it often means a reduction in working hours, lay-offs and even factory closure. The employment situation has deteriorated significantly in most manufacturing countries Kenya included. Due to mergers and closure of manufacturing plants most recent workers have been laid off. Henry Ford, an internationally renowned producer of the famous car Ford, believed that well-paid workers were not only productive and willing but themselves constituted a market for the very products they were manufacturing (African Review, July 2001).

The importance of the motor industry in international world trade is clear. The industry is a major factor in the balance of payments of the main producing countries. In 1980 international trade in road vehicles represented 15.5% of the world trade in the manufacturing industry. In Kenya this industry contributed 12% of the GDP. This explains the high government involvement in the industry (World Bank, 1983).

This sector also facilitates economic development through technological changes. Since the liberalization of the Kenyan market, stiff competition has

been observed in this industry, which has made manufacturers to invest in research and development in order maintain their status quo. Hence new makes are being introduced to the market every year. In Kenya the benefits of R&D have not been fully realized due to excess capacity and existence of a small market. The industry also facilitates the development of other industries e.g. petroleum and spare parts industry. Many components used in the automobile industry for example tyres, batteries, glass and cushions are sourced from other industries.

Silva (1984) gives reasons for the automobile industry attracting much attention in many countries. Its substantial size in terms of output, employment and investment, its contribution as a source of growth in the economy, its importance as a determinant of the balance of payment, its high 'visibility' in the market place and in the labor market, due to increased concentration of production in the hands of a limited number of producers and the psychological factor also plays an important part since cars have become a symbol of the producing nations and the performance of major automobile producers is interpreted as an indicator of performance in these countries. Furthermore, a car is the second largest item after a house for most consumers.

Thus the automotive industry has been one of the avenues through which developed nations have been able to industrialize. In many of the third world countries, the automobile industry has a small market and cannot sustain economies of large-scale production required to realize cost minimization through mass production.

1.2 Strategies of establishment of automobile industry

There are two principle ways in which a country can establish automobile industry. Local assembly approach, which is preferred by many countries as it does not impose an instant burden on a country's resources. It involves establishing the industry gradually both by discouraging importation of completely built-up vehicles in favor of local assembly of completely knocked down kits and by encouraging the manufacture of automobile components. Secondly we have the direct approach where all manufacturing units required for automobile assembly are established in a country which did not manufacture automobile before. This approach is expensive and few countries can afford (Abaga. O, 1990). A country should ensure that it adopts the approach that suits it best. However the fact that one approached has worked in one country does not necessarily mean that it will work in another.

1.3 The trend for Automobile in the 1990s

Kenya adopted the local assembly approach in 1973 (Masai, 1986). The principle aims of the local assembly industry were job creation, dissemination of skills, technical transfer, stimulation of ancillary industries, increase utilization of local inputs, raw materials, and save and earn foreign exchange. This approach with time has lost its emphasis due the unexpected disaster following the assembly of the Nyayo Pioneer car and also because locally assembled vehicles end up being very expensive. This has made the local dealers to prefer importing brand new vehicles that are much cheaper than locally assembled ones. The situation has been made worse by the

liberalization of the industry in the 90s. This has led to a huge importation of second hand vehicles, which are cheaper, and thus giving the local dealers a lot of competition. In 1986, the Kenya Government accepted the local assemblies of all types of vehicles and motor vehicle manufacturers have responded by introducing different models in the market. There are currently 40 makes in the country offering approximately 400 different models (Table a). Most of these new makes are imported while complete and very little assembly is done.

In the 90s the number of motor vehicles registered increased progressively from 12,420 in 1993 to 32063 in 1999 (table b). This 61.3% increase can be attributed to the liberalization of the market. According to table c, the quantity of imported vehicles in the 90s constituted about 85% of the registered vehicles. This is consistent with table d, which shows a continuing increase in import duty earned due to importation of cars. The local industry continues to employ thousands of Kenyans both directly and indirectly in the auto-component manufacturing sector. Therefore some modest and rationalized protection is essential.

1.4 Current situation

The motor industry in Kenya is at the verge of collapse. According to Kenya Motor Industry (KMI) Association, this industry needs to sell at least 1000 units per month in order to remain viable. This level has not been attained for the last 52 months to march this year, putting the survival of the industry in doubt. According to KMI the problems affecting the new vehicle market continued through out the year with less than 600 new units sold.

Many companies have been compelled to revisit strategy in the wake of poor bottom lines, with the focus shifting from the mere sale of cars to value-added after-sale-service and staff retrenchment (Daily Nation, Friday, April 28, 2000).

Table d, shows how the different motor vehicle companies fared in the Kenyan market. The first quarter sales for 1997 shows a drop compared to the same period in 1996. The domestic market registered sales of 936 units during the month of March, a drop of 7.3% over February. This is a reflection of the poor performance that has been experienced over the years since liberalization. The Japanese big four have continued to dominate our local market. The major franchises Toyota, Nissan, Isuzu, Mitsubishi and Peugeot continued to dominate the market, accounting for over 60% of all new vehicles sold in the local market. According to KMI there has been a decrease in the industry sales volume. During the first six months of 1996 average sales per month inched over the 1000 units mark at 1023 units compared to below 1000 units in the second half of the same year. All this has been as a result of the liberalized trading climate which has seen the number of makes available in the market grow to over thirty five and the increasingly more discerning customer who is not only worried about the price he is going to pay but also more aware of the different options each make and model offers, and the subsequent after sales spares and service back-up. The customer choice also emphasizes resale values, ease of disposability, make durability and dealer image (Monthly motor, March 2002).

Despite the prevailing tough business climate in Kenya the total sale of motor vehicles went up by 7.7% to 6,326 units in the year 2001 from 5,869 units in the previous year. DT Dobie, the local Mercedes and Nissan franchise holders maintained its overall lead in the market by selling 1,119 units in 2001, which represents a 17.68% growth over the previous year. Overall units sales comprised 239 luxury Mercedes cars and 880 Nissan saloon cars. Simba colt motors, Mitsubishi dealers sold 1,107 units, while Toyota Company and General Motors each registered sales of 1099 and 1093 units respectively (Monthly motor, march 2002). We can therefore see clearly that from the current monthly sales, it will not be possible for this industry to remain viable unless this problem is addressed which is the aim of this study.

1.5 The problem statement

The sale trend of the Kenya's new vehicles has been on the decline since 1990. From graph a, we can observe that the actual market level has been an average sale of 672 per month and is still falling, compared to a viable market level of 1000 vehicles per month and a healthy market level of more than 1500 vehicles per month. Thus this industry is not viable at the moment. In terms of employment, this industry is a major employer when all those who depend on it directly and indirectly are considered. Therefore this drop in sales means a massive loss of jobs.

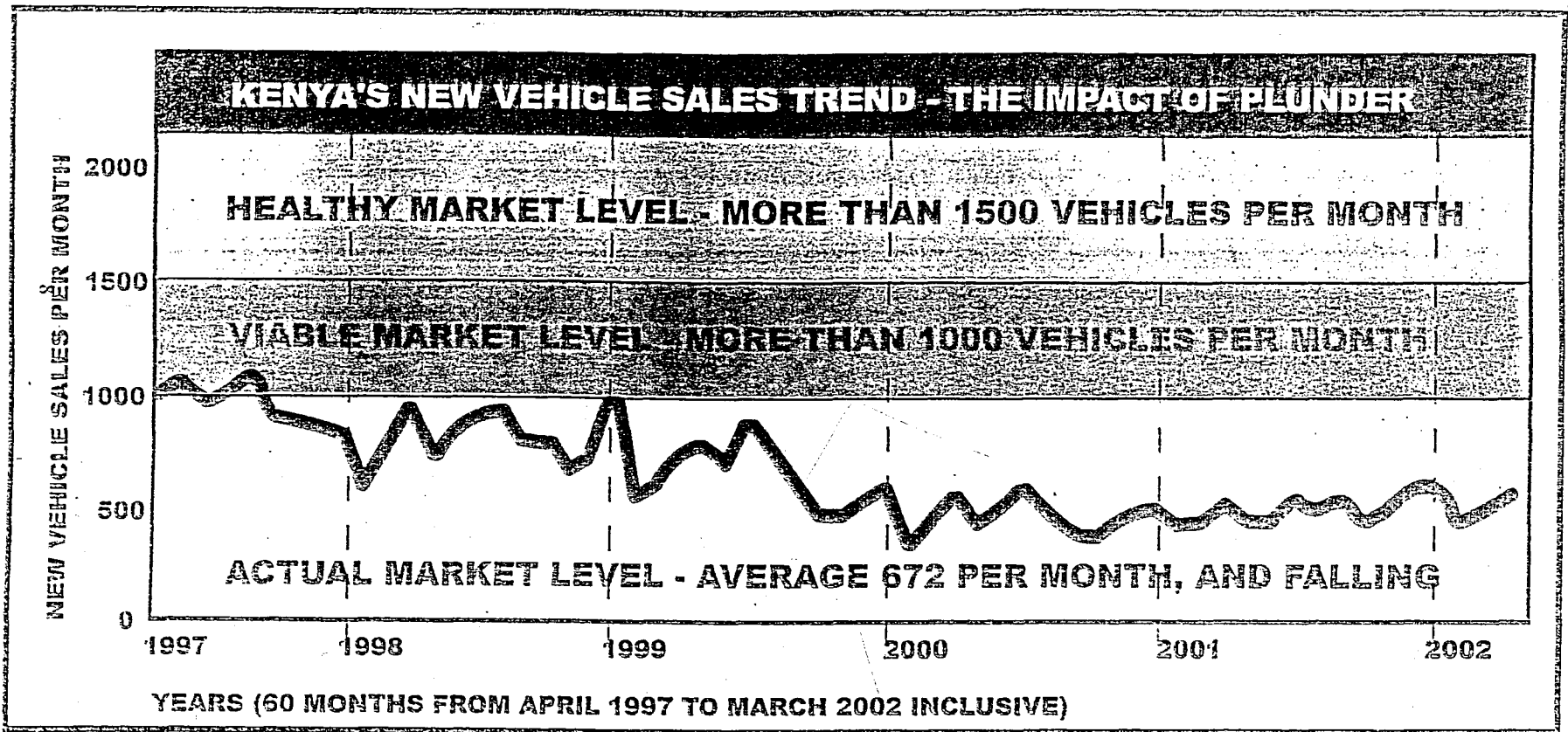
The liberalization of the economy in the 1990s has led to an increase in the importation of second hand cars. This has rendered the main stream dealers out of business who argue that these imports amount to dumping. Although

this option was adopted as a result of inefficiencies and excess capacity due to low production in the motor industry, statistics show that in the years prior to free-for-all importation, even with severe foreign exchange shortages Kenya's average monthly vehicle sales were 1200 per month, all of them built by Kenyan industry (Auto news, May 2002). Thus in general, the sale of vehicles has declined.

To date only one study of this kind has been done by Abaga (1990). In his work, he estimated a demand model for new passenger cars and pick-ups. Though his study was relevant then, there is need for a better model which will take into account the effect of liberalization among other changes.

Thus a proper knowledge of forces which determine demand for any commodity and their respective marginal importance is a prerequisite for rational policy decision in both private and public sectors. Policy intervention is needed to protect jobs, hedge investments and maintain an efficient national fleet (Marina, 1981).

Graph a
Kenya's new vehicles sales trend



1.6 Objective of the study

In light of the above challenges this paper seeks to do the following.

1. To investigate the main factors determining demand for new automobile in Kenya.
2. To ascertain the extent of significance and generate data useful in forecasting.
- 3 To draw conclusions and make necessary policy recommendations.

1.7 Justification and Significance of the study

This analysis is not only useful academically, but will provide valuable information to the industry and to the Government policy makers among other stakeholders. Since the inception of liberalization of the economy, no research has been conducted in this area and yet this industry is at the verge of collapse. Therefore the aim of this study is to address this problem and provide new information required if the industry is to survive. Again most of the studies that have been done on the motor industry have ignored the demand side.

1.8 Scope of the study

This study will focus on new vehicles in the Kenyan Automobile Industry and will use time series data from 1970 to the year 2001. A demand side approach will be used.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

In the recent past, not much has been done on demand for automobiles. Studies have been conducted on the demand side for durables in general but it was not until recently that attention shifted to demand for automobiles. In this chapter we focus on the various studies done in the past and see how different scholars have contributed towards the development of models which have been used to estimate demand for automobile in the recent past.

2.2 Theoretical Literature

The two major approaches that have been used in analyzing demand for automobile are the stock adjustment and user cost methods. Stone (1957) developed the stock adjustment model. It assumes that with a given income and prices, there exists some desired level of stock of automobiles such that the rate of purchase depends on the difference between the existing stock, some level of depreciation and the desired level.

The user cost approach developed by Wykoff (1973) is based on the assumption that the consumers derive utility from the services provided by durable goods and that it is the prices of the services, rather than the purchase price of the durable that determines the flow they will consume. However these approaches can only be used to determine the demand for clothing and household durables in the developed countries. They cannot be used in estimating demand for new durables.

O'Herlihy (1965) improved Stone's model by integrating used car prices into the analysis. He postulated a long-term relationship between the level of car stock demanded by consumers and determinant factors. The model after estimation using iterative maximum likelihood method had unsatisfactory results.

Bandeen (1957) developed a model in which he devoted his study to the relationship between automobile consumption and income. He estimated the model using least square regression method and obtained income elasticity of automobile of nearly unity.

Rhys (1972) developed a model where unlike most of the studies in the past he constructed models for both passenger cars and commercial vehicles. Both models encompassed variables, which determined the demand for cars for most practical purposes. This was a great attempt, however the amount of data he used may not be available in developing countries.

Nowicki (1969) held that the forecasting techniques used in developing countries were unsuitable for developing countries (United Nations, 1969, p.84). According to him, automobile demand follows three-stage growth pattern with a slow builds up in the initial stages followed by a steeply accelerating middle slope and then decelerating approach to an upper asymptote.

Stephens (1988) argues that although Brazil by 1980 had the eighth largest motor vehicle sector in the world, producing more than a million units

annually, one cannot argue that the concentration of resources on the building of a system of public transportation would be more appropriate to a developing economy. He further points out that there are no recent examples of the development via a capitalist mode in which the automobile has not played a prominent role.

2.2.1 Factors which influence automobile

Factors that influence automobile are many and complex and they include:

a) Demographic factors

Population growth obviously underpins growth in automobile demand over the long term. A forecast by UN shows that the absolute population increase between 1980-2000 is around 46%. The main growth areas should be Africa 77%, Latin America 65% and Asia 43%. Assuming that it does not create economic drag on the countries involved, population growth of this magnitude will contribute substantially to growth of demand for automobile, (World automobile industry, 1983).

Household characteristics will also influence both aggregate demand and the pattern of demand for automobile. The main elements as seen by Bates and Roberts in a cross-sectional context:

- i. Economies of scale resulting from shared travel.
- ii. The role of automobile in assisting the journey to work.
- iii. Factor relating to age and social- economic grouping are determinants of the willingness and ability to drive.
- iv. The budget constraint represented by household income.

Age and social economic factors will play an increasing role in shaping automobile demand. Demographic trends in many of the developing countries indicate a fall in the size of households and a likely increase in the percentage of single-person households. The main implications of a fall in household size is that, by reducing the extent of vehicle sharing, it provides further scope for growth in car ownership level and hence demand. The possibility of increase in the amount of leisure time available to household and hence an increased desire for mobility would in theory support his hypothesis, (World automobile industry, 1983).

b) Levels and Growth of income

The size of net or disposable income is a key determinant of automobile demand over the long-term. However, it has proved difficult to pinpoint the relationship between these variables, since it is not clear which measure of disposable income is relevant to car ownership. In this regard it is worth noting Parish's contention that household car ownership is to a large degree determined by the household's permanent or expected income and is unaffected by transitory or windfall income changes. This theory helps to explain the continued growth of car ownership during periods of low economic growth, (World automobile industry, 1983).

c) Operating Costs and Vehicles Prices

The combined cost of purchasing and operating a vehicle is a major determinant of demand. It may be argued that operating costs (especially those costs which are mileage-dependant e.g. fuel, repairs) have influence on the car ownership, and hence demand in the short-run. Changes in such

variable costs mainly results in adjustments in a car usage, rather than automobile demand, over the short term. This view is based on the empirical-observation tendency for household transportation budgets to generally remain constant over time: increases in certain expenses items are offset by corresponding decreases in other items within the transport budget (i.e. increases in fuel costs leads to a downward adjustment in distance traveled). If car ownership and demand are affected, it is usually observed over the medium term with a shift down to smaller vehicle sizes.

The fixed cost component (which incorporates automobile prices and related costs such as insurance and registration) has a greater influence on automobile demand than do variable costs; fixed costs also influence demand over a shorter time horizon than do variable costs. However price elasticities of automobile demand, which measure the relationship between the purchase price of automobiles and changes in quantity demanded, are very difficult to estimate precisely. As well as arriving at both a reasonable definition and measurement of the actual cost as perceived by the consumer, there is likely to be some delay in these cost effects being reflected in demand. The growth of motorization cannot be explained solely in terms of vehicle prices; but new prices do, of course, have an impact on new cars. Table e and f show clearly the prices of different vehicles and their corresponding operating costs.

The cost of credit can also influence new vehicles prices and hence automobile demand. For example high interest rates recently prevailing in the US have contributed to the marked slow down in the US automobile

market. The term of loan finance (e.g. length of repayment allowed) also may be relevant in some countries, to the extent that they can either moderate or exacerbate any consumer resistance to increase in vehicle prices. Generally speaking, however, the credit factor is mainly relevant over the short-term. Any long-term impact might be traced to institutionalized monetary practices e.g. where bank finance for certain "luxury" items such as cars has historically been made restrictive by the central banking authority.

A related effect on new automobile demand is the differential between new cars and used automobile prices. While the price of new cars has increased (partly as a result of the incorporation of new technology and safety equipment), the trade in value of used cars has risen less slowly because of their accelerated technical obsolescence. Thus the additional cost that must be borne by the customer in switching to newer models is higher; this may have a detrimental impact on new car sales. In some instances, on the other hand, differentials between new and used prices may narrow because of imported restrictions

d) Geographical Factors

In developed markets, car ownership levels tend to be lower in urban than in rural areas because the transport alternatives to the automobile available in cities (public transport, walking) and the problem of traffic congestion and parking. The supply and quality of public transport in these markets appears to be more important in influencing vehicle ownership than is the level of urbanization. Analysis in Britain has shown that areas of good and poor

access to public transport may lead to differences in vehicle ownership of up to 60 cars per thousand population. Thus all other things being equal, a decline in urban public transport services, might be expected to extend the growth parameters of automobile ownership, at least in the less heavily populated urban areas. The movement of people away from inner city areas towards medium-density urban areas may be a long term source for the future growth in car ownership, (World automobile industry, 1983).

e) Institutional Factors

The ongoing lack of suitable roads not only may slow the development of automobile markets, but also will tend to ensure that the vehicle characteristics generally demanded in these areas continue to differ from those in developed countries. Societies demand with respect to environmental control and automobile safety will have a significant impact on the type of vehicles demanded.

2.3 Empirical Literature

Steiner (1990) surveyed close to a hundred different papers with three hundred and sixty different estimated demand equations, and re-estimated the models using a larger database than those used in the studies he summarized. He pointed out that the differences in results may be seen as discouraging, but concluded that there is consistency in the results and that demand does 'adapt to changes in both income and prices'. For OECD countries, the short run elasticity for the dynamic models "appear to be around -0.2 to -0.3 and 0.35 to 0.55 for prices and income respectively". The long run elasticities were around -1.0 to -1.4, and 0.6 to 1.6 for price and

income respectively. For OECD countries, the results on price elasticities were consistent with those obtained by Pindyk (1975), but the wide range for income elasticities cast a doubt on the claim that they should be systematically higher for developing countries.

Berndt and Botero (1985), presented estimates from Mexico of a model of vehicle stock adjustments and gasoline demand. They utilized a pooled cross-section time series data set and used the dynamic gasoline demand model discussed in Drillas (1984). For the short run they found -0.23 for price elasticity and 0.31 for income elasticity. Long run price and income elasticities they obtained were -0.96 and 1.25 respectively.

According to Eskeland (1994) this model had many weaknesses and this led him to address them in his research. He modeled a car stock where he assumed that consumers in each state would calculate how much car services they want given the prices and their incomes. As relevant prices for this choice, they consider car prices and gasoline prices. He obtained price elasticities of total gasoline consumption as -0.79 in the short run and -0.8 in the long run. He however took income and price as the main determinants in his study.

Akerlof used the automobile market to illustrate and develop his thoughts in relating quality and uncertainty. He noted the large price difference between new cars and those that have just left the showroom. Although the justification for this would be the pure joy of owning a 'new' car, he offered a different explanation. The individuals in the market buy a new automobile

without knowing whether the car they will buy will be good or a lemon (bad). But they do not know with what probability q it is a good car and with probability $(1-q)$ it is a lemon; by assuming, q is the proportion of good cars produced and $(1-q)$ is the proportion of lemons. It is after owning a specific car for a length of time, that the car owner forms a good idea of the quality of this machine and this estimation is more accurate than the original estimate. An asymmetry in available information has developed. He concludes that due to this kind of behavior bad cars drive out good cars because they sell at the same price as good cars. In an extreme case no market would exist at all.

Abaga (1990) estimated the demand for automobiles for both new passenger cars and for new pick-ups. He argued that the demand for new passenger cars was a function of the stock of cars, real national income, retail price index of cars, real import price index, real interest rates and urbanization while demand for new pick-ups was a function of the variables already mentioned and credit terms, road construction and investments. The ordinary least-square method was used to estimate the coefficients to determine the significance of the explanatory variable and appropriateness of the model. He concludes that demand for cars is determined by personal disposable income, the stock of cars the prices of cars and government policy. This model however cannot be relied upon due to the serious weaknesses of the OLS method

2.4 Overview

The review shows that most of the studies are based in the developed

countries where the automobile market is mature. The amount of data required in most studies is enormous and not readily available in developing countries, indicating that most of the models would not be suitable. Most of the models were concerned with stock demand and therefore not suitable in determining the demand for new automobiles. Also it is worth noting that only one study has been done in Kenya on this topic. This study will aim at using some of the findings in this chapter to determine the variables relevant in our Kenyan context, which influence demand for new automobile using the most recent data.

CHAPTER THREE

3.0 THEORETICAL FRAMEWORK AND METHODOLOGY

3.1 Introduction

There are several problems associated with the demand estimations of durables in general and automobiles in particular. First, there is the problem of measurement. From the introductory chapter it is evident that there exist more than 40 models of automobiles. Manufacturers are busy trying to improve on the quality of their products to suit customer needs and this has resulted to differences in prices and better quality. In this study this problem will be overcome by assuming that the change in prices of new cars induce similar changes in the prices of second-hand cars by the same magnitudes.

Secondly, in estimating the demand for new automobile we are faced with the problem of the stock demand arising from automobile ownership and the problem of the flow of demand arising from the demand for new automobile. These two sets of demand are interrelated. The stock of automobile cannot be maintained let alone increased without new purchases. The stock of automobile also determines the rate of new purchases. If the services derived from the use of existing stock of automobile at a particular period are high, it follows that the demand for new purchases will be lower. It is however not easy to measure the amount of services obtained from the existing stock. For the purposes of this study, it is assumed that all automobile yield the same services to their owners so that the aggregate service yield of the existing stock of automobile is measured by their numbers.

Thirdly, there are different types of automobiles that attract different consumers. Some tend to exhibit the characteristics of veblen goods while others the characteristics of normal goods. For this study, it is assumed that automobiles are normal goods.

In this section we give the theoretical relationship between the determinants of demand for automobiles and the demand for automobiles.

3.2 Determinants of demand for automobiles

In the literature review several determinants were discussed according to the United Nations publication. This section looks at the theory that exists to support those findings and other determinants, which have not been discussed.

3.2.1 Income

Economic theory suggests that the demand for normal goods, good cars included increases with a increase in income at ceteris paribus. It therefore follows that the high-income earners will buy new cars since they can afford and not forgetting to mention that they could sell old cars to purchase new ones. With a decline in incomes, consumers tend to go for cheaper vehicles, which are mainly second hand.

3.2.5 Price

Price is one of the important determinants of demand for automobiles. Since automobiles are normal goods, their demand is inversely related to price. Thus a fall in the price of automobile will at ceteris paribus increase the

demand of automobile. As discussed in the literature review, it can be noted that price could also be affected not only by hire purchase agreements which allow low income earners to afford new vehicles but also the cost of credit.

3.2.6 Price of Substitutes

Since the Kenyan market was liberalized there has been very stiff competition between the dealers of new cars and those of second hand cars. New cars tend to be more expensive than second hand cars. Therefore, when the price of a normal good increases, economic theory suggests that the demand of that good falls, and consumers consider buying its substitute, whose demand will then increase.

3.2.4 Government Policy

The government affects the demand for automobile through its impact on price, credit facilities, running costs and import restrictions. Fiscal instruments like duty and sales tax imposed on automobiles have a direct impact on the demand through price while licensing, insurance and taxes on complementary goods such as petrol have an indirect influence via running costs. In Kenya the government imposes import duty on new cars and this therefore affects the demand for the new automobile.

3.2.5 Population

In the literature review it has been shown that population affects the demand for automobile in the long run. Increase in population over a long period of time will increase the demand for new automobile. A decrease in

population would also be expected to decrease the demand for new automobile over a long period of time. In Kenya the population has been on the increase since independence.

3.2.6 Stock of automobiles

It has been observed that demand for new cars, especially in a mature market, is inversely related to the stock of automobiles. As the market for cars approaches maturity stage, the incremental increases in stock increase at a decreasing rate. The demand for new cars, therefore, also tends to be low.

3.2.7 Cost of credit

Credit markets according to Akerlof often reflect operations of the Lemons Principle. This is because of the fact that managing agencies control huge fractions of the industrial enterprise. Also the moneylenders lend money to their clients at extortionate rates. This makes it difficult for consumers to borrow money due to the high interest rates. Therefore high interest rates discourage increased demand for new automobile. In this study, interest rates will be used to capture the extent of the impact of credit facilities on demand for automobiles.

3.2.8 Advertising

Advertising performs a dual role in influencing demand for normal goods. It gives information to the public about the new product. It also performs a persuasive role, by persuading the public to consider purchasing the new product. Advertising is therefore a powerful tool in boosting the sales of

new products especially in a liberalized market where competition exists.

3.2.9 Roads

Well-planned highways both in rural and urban areas are conducive to automobile operations. Poor infrastructure increases the cost of running automobile and therefore discourages the purchase of new vehicles. In Kenya the infrastructure has been dilapidated due to the El-nino rains and lack of donor funding. This will have a negative effect on the demand for new vehicles.

3.3 Data Source, type and limitations

This study used time -series data, covering the period 1970-2001 annual data.

Data of various variables was obtained from different sources namely:

- i) Central Bureau of Statistics (CBS)
- ii) Geography department, University of Nairobi
- iii) Various automobile dealers
- iv) Ministry of finance
- v) Ministry of planning and National Development

3.4 Hypotheses and Model Specification

The variables discussed in the theoretical framework, the prevailing Kenya's conditions and the study objectives constitutes the basis of the hypotheses to be tested in the model.

3.5 The Estimated Model

This study estimates a linear demand function for new vehicles. This is an adaptation of Abaga's model.

In particular, the demand for new cars is:

$$D_{nc} = f(Y_d, P_o, P_s, P_n, r, Imp, S, A, R_d, e),$$

Where,

D_{nc} = Demand for new automobile

Y_d = National income and $\frac{dD_{nc}}{dY_d} > 0$,

P_o = Real price index of new cars and $\frac{dD_{nc}}{dP_o} < 0$,

P_s = Real price index of Second hand cars and $\frac{dD_{nc}}{dP_s} > 0$,

P_n = Population and $\frac{dD_{nc}}{dP_n} > 0$,

r = Interest rate and $\frac{dD_{nc}}{dr} < 0$,

Imp = Value of Import duty and $\frac{dD_{nc}}{dImp} < 0$,

S = Stock of cars and $\frac{dD_{nc}}{dS} < 0$,

A = Advertising index $\frac{dD_{nc}}{dA} > 0$,

R_d = Road construction in kilometers and $\frac{dD_{nc}}{dR_d} > 0$,

e = error term

After estimating the model it was noted that it was not stationary in levels. Therefore to obtain meaningful results it was necessary to difference the variables and include their lags in the model. The ordinary least-squares method was used to estimate the coefficients to determine the significance of the explanatory variables and appropriateness of the model.

CHAPTER FOUR

4.0 DATA ANALYSIS

4.1 Introduction:

This chapter presents the results obtained after regressing the data. The only variable, which was not captured, was for advertising due to lack of available data. Therefore the following factors are considered; the lending interest rate, existing stock of automobile, gross domestic product, population, infrastructure, price index of automobile and the import price index of automobile. The influence of these factors is given by the size of their respective coefficients in the table of results. The data was analyzed using the P.C Give software.

4.1.1 Stationarity tests:

The first step involved carrying out the stationarity tests on the series so as to establish the order of integration of the series. This was necessary to enable us carry out a joint test for co-integration. This is achieved by carrying out unit roots tests for each of the series. The data series were not stationary in levels (See table h) after using Augumented Dicky Fuller test (ADF). This meant that the data had to be differenced and hence deviating from the methodology.

After differencing the data, the ADF unit root test gave the following stationarity levels.

Variable	ADF	Integration order I(n)
Dnc	-4.1097**	I(0)
DS	-5.1651**	I(0)
Dr	-4.5318**	I(0)
DPn	-6.0764**	I(0)
DImp	-5.5389**	I(0)
DRd	-4.9326**	I(0)
DPs	-5.4377**	I(0)
DPo	-4.9777**	I(0)
DGnp	-4.5420**	I(0)
Critical Value at 5%	-3.594	

From the above table all the variables were stationary. This is because the t-calculated are more than the t-critical in absolute terms.

4.1.2 Testing for co-integration

In testing for the existence of co-integration, the analysis used the Enger-Granger methodology to establish whether an error correction model was possible. The residuals from the estimated equation were tested for stationarity using the Augmented Dickey -Fuller test. The following results were obtained.

Variable	ADF	Decision
e (residual)	-3.5970*	Co-integration present
Critical Value at 5%	-3.573	

The results of the test for co-integration above show that there exists no unit root in the error term (residuals). This implies that the error term derived from the factors that determine the demand for new automobile is stationary, which further implies that there exists co-integration among the variables and therefore a long run relationship.

4.1.3 Regression results

To be able to estimate the model it was necessary to introduce lagged variables, which meant that previous year's values of variables did affect demand for new automobile. This led to the following estimated model.

Estimated results of the model:

Modelling DDnc by OLS

Variable	Coefficient	Std.Error	t-value	t-prob
Constant	0.045423	0.62275	0.073	0.5427
DGnp_2	0.015309	0.0066547	2.300	0.0344
DPo	-0.11099	0.087914	-1.262	0.2238
DPs	0.25779	0.038008	6.783	0.0000
DPn	-0.44400	0.37066	-1.198	0.2474

Dr	0.58661	0.17319	3.387	0.0035
DImp	-0.0016511	0.00056038	-2.946	0.0090
DS	0.057189	0.022174	2.579	0.0195
DRd	-0.097760	0.21767	-0.449	0.6590
e_1	-0.77437	0.24127	-3.210	0.0051

$R^2 = 0.818553$ $F(9, 17) = 8.5212$ [0.0001] $\hat{\sigma} = 1.70368$ $DW = 1.73$

RSS = 49.34272756 for 10 variables and 27 observations

AR 1- 2F(2, 15) = 0.29528 [0.7485]

ARCH 1 F(1, 15) = 0.096281 [0.7606]

Normality Chi²(2) = 4.911 [0.0566]

RESET F(1, 16) = 0.6531 [0.4309]

4.1.4 Analysis of regression results

The diagnostic tests are not significant. The AR test for autocorrelation shows that we do not have autocorrection, the ARCH test for autoregressive heteroscedasticity indicate its absence in the model. The normality test for the distribution of the residuals show that the errors are normally distributed and the RESET test for the regression specification shows that the model is correctly specified.

The R^2 that indicates the explanatory power of the model is 0.818553 or 81.86%. This implies that the model is well fitted with the variables built in the model able to explain 81.86% of the variations in demand for new

automobile. All the variables had expected signs although not all were statistically significant.

The coefficient of the e_1 was negative and significant. Statistical significance of this coefficient shows that in the short-run there is some adjustment towards the long-run solution model.

The results in the above table indicate that the demand for automobile is determined by stock of cars, gross national product, Interest rate, infrastructure, price of automobile, population, import duty and import price of automobile.

The regression results indicate that demand for automobile is positively related to stock of automobile. This is inconsistent with theory and had the unexpected sign. This could possibly be explained by the fact that individuals will not want to buy new automobile because their colleagues have bought. In this case automobile influences the social status in the community. This variable was statistically significant.

The results also indicate that there is a positive relationship between demand for new automobile and gross national income of the previous years. As income increases the demand for automobile increases. This result confirms our earlier postulation that there exists a positive relationship between demand for automobile and income. This also means that individuals take time to adjust their preferences after an increase in income.

The regression results further indicated that the demand for new automobile is inversely related to the prices of cars. Thus as the prices of new vehicles increase the quantity of new vehicles demanded decreases. Although this supports the theory this variable was not significant. The import price of new vehicles was positively related to demand for new automobile, which was an expected sign. This is because the two commodities are substitutes. When the price of second hand vehicles increases then consumers will prefer buying new ones and vice versa.

Import duty was inversely related to the demand for new automobile and significant. This means that the government's policy to raise duty impacts negatively on new automobile. There has been a cry from dealers in the automobile industry for the government to lower duty on raw materials for manufacturing automobile.

The lending interest rate had an unexpected sign. It was positively related to the demand for new automobile. This means that as the lending rate increases some consumers are encouraged from borrowing and therefore they purchase new automobile. This however could encourage defaulters as we have seen in the past. Banks have closed down due to many defaulters in the recent past. This has been referred to as moral hazard where some investors borrow with an intention to default in future.

Roads as a variable had a negative sign although not significant. This means that improvement of roads and construction of new ones encourages the purchase of more vehicles. Population had an unexpected sign. It was

negatively related to demand for new automobile. This could mean that in Kenya the increase in population has caused more harm than good. The number of unemployed people and increased dependency reflects this. This has discouraged the purchases of new automobile.

Therefore from the estimated model four variables namely price of new automobile, Road, value of import duty and the existing stock of cars were not significant. If these variables were to be dropped the following preferred model would be obtained.

PREFERRED MODEL

Modelling DDnc by OLS

Variable	Coefficient	Std.Error	t-value	t-prob
Constant	-0.63935	0.45988	-1.3900	0.1797
DGnp_2	0.016156	0.0066023	2.447	0.0238
DPs	0.23324	0.034129	6.834	0.0000
Dr	0.48339	0.15934	3.034	0.0066
Dimp	-0.0018981	0.00048	-3.958	0.0008
DS	0.051424	0.021269	2.418	0.0253
e_1	-0.73318	0.23879	-3.070	0.0060

$R^2 = 0.788503$ $F(6, 20) = 12.427$ $[0.0000]$ $\hat{\sigma} = 1.6958$ $DW = 1.72$

RSS = 57.51455449 for 7 variables and 27 observations

This model indicates that all variables are significant at 5 % level. Therefore it can be concluded that gross national product, price of second hand vehicles, Stock of automobile, import duty and interest rate are the major factors that determine the demand for new automobile.

CHAPTER FIVE

5.0 SUMMARY AND POLICY IMPLICATIONS

5.1 Summary of the study

The results of this study indicate that demand for new cars is determined by personal disposable income, Stock of automobile, import prices of cars, cost of credit and import duty. Most of the variables were found to be consistent with theory and had the expected signs. Three variables were not significant spite of some of them having the correct signs. The other variables were significant at 5% level.

5.2 The policy implications of the study

The regression results indicate that import prices were positively related to the demand for new automobile in Kenya whereas import duty was inversely related. These two variables confirm the cry that has been in the motor industry about it being at the verge of collapse. This has been due to failure in the government fiscal policy and the government's objectives of the establishment of the motor vehicle assembly plants. The import duty imposed on imported vehicles is not high enough to discourage importation of vehicles and in turn promote local assembly of vehicles. Second hand vehicles are substitutes to new ones. Therefore if high duties are not imposed on the former the latter can not flourish. This has been a serious problem in Kenya since the liberalization of the economy in the early 90s. According to the D.T..Dobie general manager, it's a high time that the government lowered the import duty on new cars to ensure fair competition in the librcralized market. He said that the large amount charged as import duty on vehicles with 1800cc and above was the cause of a huge slump in sales and the poor

growth in the motor industry. He adds that "Assembling is still vital to the economy of this country. We shall not abandon the line due to importation of second-hand cars", (Daily Nation, Saturday, April 8, 2000).

The GDP had a positive sign and was significant. This means that if the income of individuals increases then they constitute a market for automobile. Henry Ford says that well paid workers constitute a market for the same product they are involved in producing or manufacturing. Therefore the government should endeavor to promote investments which will in turn help in generation of incomes hence boosting the automobile industry.

The study has shown that the increase in the population over time in Kenya has led to a low demand in automobile. This would mean that our economy has not been growing fast enough to be able to create employment, investments and increased production in the automobile industry. The increased population would constitute a market for new automobile. Recently there has been evidence of retrenchment going on in the country, closure of companies and reduction in payment of wages and salaries. This in turn has increased the dependency ratio leading to a very small growth rate if not none of the economy. The government will therefore need to address this problem.

The study also indicates that the cost of borrowing is positively related to the demand for new automobile. As pointed out by arkelof in his article entitled 'Moral Hazard' this would mean that although individuals can't be

able to purchase new vehicles due to lack of credit facility there are others who will borrow with an intention of defaulting. This is a caution to the banks to lend only creditworthy individuals if their survival is to be guaranteed. There has been a huge cry for banks to lower the interest rates so that more individuals can access credit. This would in turn boost the automobile industry.

Infrastructure has an important role in increasing demand for new automobile. There is a great need for the government and the private sector to continue investing more to improve roads and construct new roads to make new areas accessible. This will promote the automobile industry among others.

5.3 Limitations of the study

The data used in this study is secondary data. Its accuracy may not be guaranteed. There is no way of forecasting the demand for automobile. The methods employed range from hunches to elaborate mathematical-statistical formulations. The method employed depended on the availability and quality of data. The data used for this study were most probably compiled for other purposes and limit their usefulness for demand analysis. The advertising variable data was not available. This led to the omission of an important variable.

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APPENDICES

Table a. Motor vehicle market penetration*

MAKE	CALENDAR YEAR 1996		January 97	
	SOLD	%	SOLD	%
TOYOTA	1861	15.4	164	17
PEUGEOT	1142	9.4	100	10.4
ISUZU	1608	13.3	108	11.2
NISSAN	1640	13.6	149	15.5
MINITUBISHI CMC	92	0.8		
MINITUBISHI FUSO	318	2.6		
MINITUBISHI SCM	961	7.9	133	13.8
ASHOK	15	0.1		
ASIA	21	0.2	2	0.2
AUDI	0	0		
BEDFORD	36	0.3		
BMW	71	0.6	3	0.3
DAF	15	0.1	1	0.1
DAIHATSU	77	0.6	4	0.4
DAEWOO	356	2.9	41	4.3
EICHER FE444	85	0.7		
FIAT	51	0.4		
FIAT IVECO	146	1.2	13	1.3
HINO	28	0.2		
HONDA	62	0.5	24	2.5
HYUNDAI	458	3.8	20	2.1
KIA	166	1.4	12	1.2
LAND ROVER	355	2.9	37	3.8
RANGE ROVER	18	0.1	3	0.3
VOLKSWAGEN	94	0.8	9	0.9
MARUTI	259	2.1	18	1.9
MAZDA	543	4.5	37	3.8
MERCEDES	388	3.2	26	2.7
MINI MOKE	1	0		
NISSAN DIESEL	265	2.2	23	2.4
NIVA	7	0.1		
OPEL	83	0.7	12	1.2
PROTON	1	0	1	0.1
RENAULT	45	0.4		
SANAYI	19	0.2	2	0.2
SSANGYONG	57	0.5		
SUBARU	64	0.5	6	0.6
SUZUKI	244	2	15	1.6
TATA	169	1.4		
TATA AUTANO	39	0.3		
VOLVO	128	1.1		
DFM	110	0.9		
TOTAL	12098		963	

Source: Monthly motoring, March 1997.*

* There is no available information capturing the actual value of the vehicles

Table b. Road Vehicles

New Registration	Years-Numbers									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Motor cars	7,155	6,682	6,328	6,370	9,730	9,779	12,694	13,254	16,301	16,037
Utilities Panel vans,										
Pickups e.t.c	4,996	3,943	3,728	2,510	3,880	5,778	7,711	7,544	7,295	8,121
Lorries & Trucks	1,611	1,272	1,105	750	1,315	1,778	2,222	2,732	2,578	2,705
Buses & Minibus	1,239	1,156	1,165	814	817	1,556	1,834	1,858	1,761	1,958
Motor & auto cycles	1,188	1,246	1,364	1,133	1,488	1,778	2,328	2,415	1,980	1,708
Other Motor Vehicles	1,415	789	431	552	657	1,111	1,201	1,410	1,258	1,482
Trailers	419	423	299	291	541	444	674	680	539	52
Total	18,023	15,519	14,420	12,420	18,428	22,224	28,664	29,893	31,712	32,063

Source: Office the Registrar of Motor Vehicles & Central Bureau of
Statistics

Table c. Quantity of motor vehicles imported*¹

	Quantity imported							
	1992	1993	1994	1995	1996	1997	1998	1999
Road Motor Vehicles								
Passenger motor cars	4895	7,420	30,968.40	25,429.00	12,927	20,107	25,112	26,778
Buses, Lorries & Trucks	927	884	5,156	3,020.00	1,133	4,666	6,072	6,180
Motor cycles	1,116	1,783	1,956	1,870	1,432	952	1,125	1,421
Bicycles	72,733	54,363	61,078	57,720	12,187	20,132	30,781	28,870

Source: Annual Trade reports: Kenya Customs and Excise Departments.

Table d. Import duties earned from imported motor vehicles in thousands.

Import Duties	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Motor Vehicles										
i) Passenger Cars	13,401.70	14,264.70	24,451.00	53,296.00	70,413.50	61,850.00	89,376.80	92,712.80	96,112.00	102,550.00
ii) Buses, Lorries & Trucks	29,371.90	18,773.00	2,482.00	16,759.00	29,197.30	18,478.00	55,655.10	58,122.10	71,212.00	75,115.00
TOTAL	42,773.60	33,037.70	26,933.00	70,055.00	99,610.80	80,328.00	145,031.90	150,834.90	167,324.00	177,665.00

Source: Central Bureau of Statistics.

¹ It was not possible to express table c in terms of new and old imports.

Table e. Vehicles running costs

AA OF KENYA VEHICLES RUNNING COSTS												
VALID FROM JUNE 2001 - ALL COSTS IN SHILLINGS												
2WD/4WD PETROL/DIESEL	2WD Pet	2WD Pet	2WD Pet	2WD Pet	2WD Pet	2WD Pet	4WD Pet	4WD Pet	4WD Pet	4WD Pet	4WD Dies	4V
ENGINE CAPACITY UP TO...	1050cc	1350cc	1650cc	2000cc	2600cc	2600cc+	1000cc	2000cc	3000cc	4600cc	3000cc	4C
FIXED COSTS/YEAR												
Road license	1140	1300	1950	3090	7315	8125	1140	3090	8125	1300	8125	
Comp insurance	83700	103174	125384	232850	335775	524253	99990	250528	239033	546683	318219	
Depreciation	88724	152480	193927	325363	336885	767085	123500	319244	373119	601460	584660	
Interest on capex	121318	204488	261922	433380	454748	1015944	172194	447266	517456	815416	793501	
Parks, fines, etc	18600	18600	18600	18600	18600	18600	18600	18600	18600	18600	18600	
AA subs	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	
Fixed cost per km	10.53	16.08	20.14	28.21	32.66	64.9	13.93	28.92	32.19	55.49	47.93	
OPERATING COST/KM												
Fuel	4.68	5.37	5.85	7.11	12.01	15.39	5.63	7.8	9.75	12.19	5.28	
Oil	0.21	0.27	0.33	0.4	0.52	0.52	0.2	0.4	0.6	0.92	0.6	
Service	0.76	0.99	1.23	1.53	3.46	3.46	0.61	1.42	1.61	1.79	3.46	
Repairs	2.4	3.13	3.85	4.82	7.84	7.84	2.4	5.98	8.12	9.02	7.21	
Tyres/Tubes	0.53	0.53	0.86	0.86	1.46	1.46	1.42	3.94	3.94	3.94	3.94	
Op costs per km	8.58	10.29	12.12	14.72	25.29	28.67	10.26	19.54	24.02	27.86	20.49	
Extra mileage claim/km	9.00	11.00	13.00	15.00	26.00	29.00	11.00	20.00	25.00	28.00	21.00	
Full cost claim/km	19.15	26.4	32.3	42.95	57.95	93.6	24.2	48.5	56.25	83.35	68.45	
Average new price	0.78m	1.31m	1.67m	2.77m	2.90m	6.49m	1.10m	2.86m	3.31m	5.21m	5.07m	
Op costs for 100,000kms	0.86m	1.03m	1.21m	1.47m	2.53m	2.88m	1.03m	1.95m	2.40m	2.79m	2.05m	

Source: Automobile Association of Kenya.

Table f. Vehicles running costs

AA OF KENYA VEHICLES RUNNING COSTS											
VALID FROM JUNE 2001 - ALL COSTS IN SHILLINGS											
PICK-UP/TRUCK/MINIBUS	P-UP Pet	P-UP Pet	P-UP 4P	P-UP Dies	P-UP 4D	P-UP 4D	Truck	Truck	Truck	M-bus D	M-bus P
ENGINE CAPACITY/PAYLOAD	1400cc	2000cc	3000cc	3000cc	3000cc	4000cc+	3-ton	7-ton	9-ton	2500cc	2500cc
FIXED COSTS/YEAR											
Road license	3625	4275	5005	5005	5005	9315	7930	18115	21715	18320	18320
Comp insurance	103740	138824	224412	161526	208038	262800	203760	367807	531959	542343	529133
Depreciation	107704	155488	259836	189252	255036	308076	219188	367208	320580	266644	255424
Interest on capex	150121	212456	350649	258572	344388	413578	302302	582049	789184	357459	342822
Parks, fines, etc	18600	18600	18600	18600	18600	18600	18600	18600	18600	18600	18600
AA subs	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Fixed cost per km	10.73	14.78	23.91	17.65	23.25	28.19	20.95	45.2	56.15	33.49	32.41
OPERATING COST/KM											
Fuel	5.32	7.31	11.7	4.13	5	6.79	7.31	10.56	13.57	5.92	7.43
Oil	0.28	0.4	0.6	0.6	0.6	0.8	1.26	1.88	2.18	0.5	0.5
Service	1.1	1.9	3.23	3.46	3.46	4.61	4.61	6.92	9.22	3.46	1.84
Repairs	3.36	4.87	6.74	7.21	7.21	9.02	9.02	14.43	18.05	7.21	5.83
Tyres/Tubes	1.05	1.23	1.49	1.28	1.49	1.49	2.24	4.63	6.6	1.23	1.23
Op costs per km	11.11	15.71	23.76	16.68	17.76	22.71	24.44	38.42	49.62	18.32	16.83
Extra mileage claim/km	12.00	16.00	24.00	17.00	18.00	23.00	25.00	39.00	50.00	19.00	17.00
Full cost claim/km	21.85	30.5	47.7	34.35	40.95	50.95	45.4	83.65	105.8	51.85	49.25
Average new price	0.96m	1.36m	2.24m	1.65m	2.20m	2.64m	1.93m	3.87m	4.85m	2.28m	2.19m
Op costs for 100,000 kms	1.11m	1.57m	2.38m	1.67m	1.77m	2.27m	2.44m	3.84m	4.96m	1.83m	1.68m

Source: Automobile Association of Kenya.

Table g Data

Year	Dnc	S	Gnp (KShs)	Po	r	Pn (pple)	Ps	Rd (km)	Imp (Shs)
	'000	'000	'000,000	Index	%	'000	Index	'000,000	'000,000
1970	20.154	137.271	11.879	3.6	9	11.23	84	44.9315	5.925
1971	21.008	149.75	12.845	3.7	9	11.67	99	46.6632	7.551
1972	18.168	159.969	13.776	3.9	9	12.07	86	48.6979	6.65
1973	16.474	164.222	15.79	4.3	9	12.48	83	52.3552	8.319
1974	17.225	184.086	18.776	5.1	9.5	12.91	94	52.3307	11.937
1975	15.988	199.715	21.14	6	10	13.41	70	50.0915	12.697
1976	16.246	203.446	25.562	6.7	10	13.85	68	50.4038	16.66
1977	24.105	214.351	32.699	7.7	10	14.35	82	50.5714	25.626
1978	24.971	225.447	35.601	9	10	14.88	96	51.3679	35.281
1979	20.883	232.029	39.543	9.7	10	15.33	78	51.4725	28.656
1980	23.246	240.435	44.648	11.1	10.58	16.67	90	53.5776	48.603
1981	18.848	246.132	51.641	12.4	12.42	17.34	70	53.7887	56.299
1982	15.061	249.162	58.214	14.9	14.5	18.04	60	54.5837	53.057
1983	13.94	250.919	66.218	16.7	15.83	18.77	47	54.5837	62.464
1984	15.694	266.613	72.55	18.4	14.42	19.54	55	54.1632	57.122
1985	13.663	280.191	100.831	20.8	14	20.33	51	53.2711	85.683
1986	16.955	281.41	117.472	21.8	14	21.16	60	54.4735	88.199
1987	18.727	296.879	131.169	23.4	14	22.94	63	61.6877	102.574
1988	19.624	316.503	151.194	26	15	23.88	71	61.6877	105.901
1989	18.405	334.512	171.589	29.4	17.26	24.87	74	62.2845	199.729
1990	18.623	333.857	195.536	34	18.25	24.03	71	62.5725	91.386
1991	15.521	347.726	22.225	40.7	19	25.91	66	63.1202	1338.32
1992	14.784	385.636	264.967	52.7	21.07	25.7	64	63.3243	3875.74
1993	12.42	398.204	333.613	76.9	29.99	28.11	69	63.6534	5818.58
1994	18.428	398.204	400.722	99.2	36.24	29.29	86	63.9419	9484.76
1995	22.224	400.517	465.653	100	28.8	30.52	100	63.9419	6424.28
1996	28.664	464.547	527.967	108.8	33.79	31.8	99	63.9419	6589.6
1997	29.893	485.151	623.354	121.9	30.25	28.41	105	63.9423	6679.16
1998	31.712	549.913	69.212	129.3	29.49	29.34	107	63.2906	6752.446
1999	27.892	576.48	748.925	133.8	22.38	30.03	106	63.2906	6910.337

Table h: Over parameterized Model

Modelling DDnc by OLS

Variable	Coefficient	Std.Error	t-value	t-prob
Constant	-2.9999	5.1362	-0.584	0.6635
DS	0.25279	0.31813	0.795	0.5725
DS_1	0.26874	0.49379	0.544	0.6827
DS_2	-0.029670	0.30900	-0.096	0.9391
DGnp	0.015921	0.074857	0.213	0.8666
DGnp_1	0.026833	0.11113	0.241	0.8492
DGnp_2	0.0096270	0.12964	0.074	0.9528
DPo	-1.9486	2.9625	-0.658	0.6296
DPo_1	-0.057742	2.9661	-0.019	0.9876
DPo_2	0.54197	3.1303	0.173	0.8909
Dr	1.5200	2.6344	0.577	0.6668
Dr_1	1.7765	2.1411	0.830	0.5591
Dr_2	0.56924	2.6712	0.213	0.8663
DPn	0.59762	2.7061	0.221	0.8616
DPn_1	-1.2318	5.8137	-0.212	0.8671
DPn_2	1.2293	6.8426	0.180	0.8868
DPs	0.26755	0.14808	1.807	0.3218
DPs_1	0.020063	0.11947	0.168	0.8941
DPs_2	0.012323	0.16071	0.077	0.9513
DRd	-0.094815	0.96722	-0.098	0.9378
DRd_1	0.014340	0.99530	0.014	0.9908
DRd_2	-1.3941	1.3930	-1.001	0.4997
DImp	0.0037560	0.012160	0.309	0.8093
DImp_1	-0.00048140	0.0089710	-0.054	0.9659
DImp_2	-0.0017784	0.014925	-0.119	0.9245
e_1	-0.78018	0.91889	-0.849	0.5519

$R^2 = 0.95508$ $F(25, 1) = 0.85048$ [0.7114] $\hat{\sigma} = 3.49506$ DW = 3.01
 RSS = 12.21541757 for 26 variables and 27 observations