FACTORS INFLUENCING THE SUPPLY RESPONSE
-a case study on smallholders producing coffee in Kilimanjaro, Tanzania

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Abstract

One of the aims with the Structural Adjustment Programs is to raise the export in the country. Coffee is the most important cash crop in Tanzania but faces a declining trend in production despite these reform programs. We have focused on the smallholders in Kilimanjaro, a traditional coffee-growing region in Tanzania, with the objectives to find the factors that influence the farmer in his decision about the production and to find explanations to the declining trend. A quantitative together with qualitative analysis based on our field study in Kilimanjaro made us find the most important factors. We found that the reform programs had had a positive impact on the production but other obstacles were affecting the sector negatively.

Key words: Coffee Production, Kilimanjaro, Farmer Decision, Smallholders, Structural Adjustment Programs.
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<td>CPI</td>
<td>Consumer Price Index</td>
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<td>FMS</td>
<td>Farm Management Survey</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>IMF</td>
<td>International Monetary Fund</td>
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<td>Kilimanjaro Co-operative Bank</td>
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<td>TCMB</td>
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<td>TSh</td>
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Map of Tanzania
1. Introduction

Since 1986 several Structural Adjustment Programmes have been implemented in Tanzania. One of the main objectives of these programmes is to encourage growth and to increase the country's export. Coffee is the major agricultural cash crop in Tanzania and contributed in 1999 with one fifth of the total export earnings (Maro (2000), p. 3). Statistical data starting at the independence in 1964 show an increasing coffee production until it reaches a peak in 1980. Despite the aims of the reform programmes, the trend after the early 1980s is downward sloping. Consequently, this decline is of major concern for the coffee industry and the country. It is crucial to identify the causes of decline in order to improve the export and to bring earnings to the farmers and the country as a whole.

1.1 Demarcations and objectives

Due to the time frame for this essay we have limited our case study to examine only one coffee-producing region in Tanzania. We also find it more relevant to thoroughly investigate problems at a local level in order to get a deeper understanding of the subject. The region we have chosen is Kilimanjaro, which traditionally is an important coffee-producing area in the north of Tanzania on the border to Kenya. Another convenient and contributing reason for choosing the region Kilimanjaro is the fact that several important coffee institutions are situated in Moshi, the largest town in the region. We will only examine the small-scale farmers, as these are important actors in the Tanzanian coffee industry and account for 95% of the total production (Maro (2000), p. 1). Our study entails one further limitation concerning the time frame since we only concentrate on data between 1983 and 1998. We aim to investigate the following objectives:

Which factors influence the small farmer in Kilimanjaro in his decisions concerning the coffee production?

In analysing these factors we hope to find the answer to our next question:

Why has the production in Kilimanjaro declined despite the reform programmes?
1.2 Material and method

The content in this essay is based partly on primary data, and partly on published and unpublished secondary data collected in Tanzania during our field study in the autumn 2000. Interviews with different people related to the coffee industry have been carried out as a complement to already written material. Some of the individuals have been selected because of their profession and others more randomly, but they all have great knowledge on the subject. The interviewed persons are listed on page 60. Collected secondary data origins from different governmental institutions, organisations and independent studies. We have also carried out additional readings and searches on the Internet and in literature before and after the visit in Tanzania. Some of the sources are only used as a foundation to our background knowledge and will not always be referred to directly in the text. All our sources can be found in the references on page 57 and forward.

Our quantitative method for estimating the supply response is the nerlovian supply response model, funded by Marc Nerlove in 1956- 58. The estimation will be done in the statistical computer program Limdep. Empirical studies, theory and analysis are in this essay to a certain extent incorporated, in order to simplify the readability. Economic reasoning will follow throughout the essay.

1.2 Criticism of the sources

In our interviews we have tried to form our questions in an unbiased way and the interviewee has been able to take a leading and explaining role. A large number of interviews have been carried out in order to gain as much knowledge as possible and to get a wider perspective. But the great amount has also caused confusion due to contradictory information. When interviewing some of the farmers it has been necessary to use an interpreter. This may have caused both biased questions and answers. The trustworthiness may therefore to some extent be questioned. Some of the interviewed persons have chosen to be anonymous which we fully respect. We have further experienced problems with secondary data. Problems with regard to the access of and the finding of reliable statistical data for our time period have been ever present; data also differs in some cases even though it is from the same source. We have tried to solve the obstacle of contradictory information (both from primary and secondary data) by using the most frequent opinion or data and further, the relevance has been considered. Subjectivity from our side may therefore be present.
1.3 Disposition

The reader will be given useful background information in chapter two. The chapter consists of the historical movement of the Structural Adjustment Programmes in Tanzania and the features of coffee in Kilimanjaro. This chapter also highlights the importance of our essay. Existing economic theories concerning the farmers’ decisions about the production in chapter three and the derivation of the supply response model in chapter four will be a foundation for our analysis. In the fifth chapter quantitative factors influencing the farmer will be presented and discussed with the help of a regression analysis on the supply response. Chapter six consists of a qualitative analysis of the remaining obstacles to the coffee production. In chapter six concluding remarks and policy recommendations will complete the essay.
2 Background

We will in this chapter describe the development towards the Structural Adjustment Programmes (SAPs). To enlighten the reader as to the importance of this essay, the role of coffee for the economy will further be stressed by using relevant statistical data. The attributes of coffee and the characteristics of the most important market participants will also be brought to attention.

2.1 Towards structural adjustment - a paradigm shift

In the post-war era criticism rose towards the market economy and it was now stressed that markets are rather imperfect than perfect in most countries. Developing countries were to a large extent ruled by monopolies and oligopolies and not by perfect competition. It has also been claimed that the supply side in these countries reacted less flexible to prices than developed countries did due to several market failures. Most developing countries therefore started to increase the role of the state during these years. Regulation and control became, to a greater extent, a replacement for the market forces in different sectors. Trade barriers for the prevention of imports were introduced to protect the domestic industrial production whereas agricultural export contributed to the capital stock instead, directly through export taxes or indirectly through lower producer prices. Responsibility for the marketing of export products was, in most cases, taken over by governmental monopolies, called marketing boards. The agricultural sector felt discriminated against and the economic situation for the farmers was strengthened. To compensate for these negative effects on the production, inputs such as fertilisers were subsidised by the government (Lundahl (1995), p 128-139).

In 1964 Julius Nyerere became the first president in the new independent United Republic of Tanzania. During his leadership Tanzania became known as a symbol for African socialism and a prototype for other poor countries (Christensen (1999), p. 19). The Arusha declaration was adopted in early 1967, which stated that a socialist society were to be established. People should be moved into agricultural collectives called Ujamaas where communal farming should take place (Havnevik (1993), p. 42-44). Together with these reforms large-scale programmes to improve health-, water- and education facilities were implemented. The process of moving people into the Ujamaa-villages was from the beginning voluntary but to get access to these new services the people were more or less forced to move. During the time period following the adoption of the Arusha declaration the growth rates were good and the coffee industry experienced an increasing trend. The annual rate of growth of GDP per capita was 2.5 % between 1967 and 1973 (Havnevik (1993), p. 46). Many countries believed in the Tanzanian model and supported the development with aid (Christensen (1999), p.19).
But in the end of the 1970’s negative trends appeared due to several external chocks. The oil crises in 1973 and 1979, the collapse of the East African Union (1977) and the war with Uganda in 1978 resulted in stagnation, increasing indebtedness, and decreasing growth, et cetera. This economic crisis period seemed to be a trend in all of Sub Saharan Africa (Rösch (1995), p. 91). During this decade a neo-classical counter-revolution was developed on the international arena, which stressed that the market, despite its constraints, is more effective than the socialist state as an instrument of resource allocation and growth. Pleaders emphasised that state intervention had gone too far. The new theory did not encourage the state to take a totally passive role; instead it should continue to ease competition by providing market information and infrastructure for example. Policy towards the promotion of exports was also stressed (Lundahl (1995), p. 128-139).

In the Berg report in the early 1980s the first Structural Adjustment Programmes were introduced (Ponte (2000), p.2). The debt-crisis countries were to carry out the reforms as a prerequisite to receive aid, and economic growth was to come from export. The aims with these programmes were, and remain, threefold:

- **Stabilisation of the economy.** Stabilisation aims to enforce a sustainable current account and keep the inflation at low rates in order to achieve both external and internal macroeconomic balance.

- **Liberalisation.** The objective is to ease the role of the state in the economy, i.e. open up the markets for competition and reduce monopolies and monopsonies. The government should focus on complementary activities where the private sphere has no interest, such as in public goods. Allocation of resources is expected to improve in free market, resulting in increased efficiency when no single player acts as a monopoly or a monopsony (Larsson (1994), p. 50).

- **Structural adjustments.** A goal is to shift attention and resources from non-tradable to tradable goods. A desirable outcome of increased exposure on international markets is the expansion of the foreign exchange reserve. This will hopefully boost the country's growth rate and increase efficiency in resource allocation. Instruments used are devaluation of the currency and deregulation, which promotes export.

Disagreements on targets between the Tanzanian government on one side and the International Monetary Fund (IMF) together with the World Bank on the other, led to a delay in the introduction of the SAPs in Tanzania in the first half of the 1980s (Havnevik (1993), p. 287-290). The Tanzanian government itself implemented some reform programmes in an effort to stabilise the economy. The results were modest, partly because of lack of financial resources due to withdrawn aid from most donor countries. Tanzania was more or less forced to continue the conversations with the IMF and the World Bank. After the resignation of President Julius Nyerere in 1985, the new president Ali Hassan Mwinyi took a step towards a more liberal policy and, as a consequence, the first SAP was implemented in co-operation with the IMF and the World Bank in 1986.
2.2 Effects of the Structural Adjustment Programmes

The farmers could expect different outcomes from the Structural Adjustment Programmes. Trade barriers, which had protected the industry and indirectly discriminated against the farmers, would be reduced and higher producer prices would hopefully follow from a liberalised market. But on the other hand, the reforms could have negative consequences. Reduction of monopolies and monopsonies together with prices that now were set at world market rates would bring in more uncertainty and risk. The current account in the country was to be held at a stable level and public expenditures were to be kept down. This policy caused investments in the agricultural sector to decrease and eliminated the subsidies. As a consequence, the farmers would gain and loose at the same time.
2.3 The importance of smallholder coffee in Kilimanjaro

We aim to stress the importance of smallholder mild arabica coffee in Kilimanjaro by presenting a stepwise model and from that examine the features of coffee. We will begin with a presentation of the role of agricultural export in Tanzania. In the next step we will focus on the role and species of coffee. This leads us to the final step where we describe the situation in our region of interest.

Figure 1. The importance of coffee

Tanzania

Agriculture 85,0 % (1)

Others 15,0 % (1)

Coffee 33,2 % (2)

Cashew nuts 32,5 % (2)

Cotton 15,6 % (2)

Tobacco 7,4 % (2)

Others 11,3 % (2)

Mild arabica 58,9 % (3)

Robusta 32,1 % (3)

Hard arabica 9,0 % (3)

Kilimanjaro 16,3 % *

Other regions 83,7 % *

Smallholders 98,3 % **

Estates 1,7 % **

Note:  
(1) % of total value of export in Tanzania  
(2) % of total value of export of agriculture in Tanzania  
(3) % of clean coffee produced in Tanzania  
* % of mild arabica produced in Kilimanjaro  
** % of mild arabica produced in Kilimanjaro by smallholders

2.3.1 The role of agriculture

The economy in Tanzania is heavily dependent on agriculture, which in 1999 accounted for 44.8% of GDP and provided 85.0% of the total value of export (www.worldbank.org, 2001-01-19). Further, approximately 80% of the working population were involved in the agricultural sector in 1999, both for commercial purposes and self-subsistent household\(^1\). The importance of agriculture for the Tanzanian economy is therefore, as in the most developing countries, severe.

2.3.2 The role of coffee

Coffee was in 1998 the biggest cash crop contributing 33.2% to the total value of agricultural export (BD (2000), p.10). Almost all coffee produced is being exported, less than 1000 tonnes per annum are consumed within the country\(^2\) (CSSS (1998), appendix 12). Over 400 000 families are dependent on coffee as a significant portion of their income, and 7% of the total population work directly in the sector (CSSS (1998), p. 3).

There are two species of coffee grown in Tanzania, arabica and robusta. The former is divided into two types, mild and hard. Out of clean coffee produced in Tanzania in 1998/99 was 58.9% mild arabica, 32.1% was robusta and only 9.0% was hard arabica (statistics from TCB).

As described above coffee is a very important crop in Tanzania, but on the world market Tanzanian coffee only accounts for 0.8% of total world production and 0.9% of the global arabica production (CSSS (1998), appendix A1). The International Coffee Organisation (ICS) count Colombia, Tanzania and Kenya together as a Colombian Mild group. Tanzania contributes with only 5% to this production. Consequently, the Tanzanian mild arabica production is a competitor to Kenya and the major producer Colombia, but the small market share makes Tanzania a small actor on the world trade arena.

2.3.3 The role of the region Kilimanjaro

Coffee grown in this region is the mild arabica, which is considered to have higher quality than both robusta and hard arabica. Of all mild arabica produced in Tanzania 1998/99, 16.3% was produced by the smallholders in Kilimanjaro (statistics from TCB). The smallholders produce the majority of the total clean arabica coffee in the region, 98.3% compared to 1.7% by the estates (statistics from TCB). Mild arabica coffee is grown best on a high altitude between 600 and 2000m, in a potash-rich soil on slopes of extinct volcanoes. These conditions make the slopes of mount Kilimanjaro a suitable area for mild arabica (EA (1982), p. 188-189). Coffee growing has a long tradition in the Kilimanjaro region, 61% of the

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\(^2\) 1999 was the total production of clean coffee in Tanzania 49 000 tonnes, i.e. about 2% of the coffee was consumed within the country and the rest was exported (Statistics from TCB).
farmers have been coffee producers for more than 25 years (CSSS (1998), appendix F32). The coffee tree is often planted among other crops.

Coffee-banana plantations are the most common mixed plantation system in Kilimanjaro; these crops are good complements since the banana tree gives the coffee tree shade and wind-shelter. On top of the practical side of intercropping, the system contributes to the food supply. Maize and beans are also popular food crops to interplant with coffee.

Tanzanian coffee might not be a giant on the world market but in Tanzania it matters to a great extent. Numerous farmers in Kilimanjaro rely on the income derived from mild arabica coffee and the production contributes to the export earnings as the biggest export crop in Tanzania.

### 2.4 Trends in production

Despite the export promoting reform programmes and the importance of coffee for the country as a whole the coffee production in Kilimanjaro and in Tanzania has declined in the last 20 years as shown in figure 1. Other important export crops such as tobacco, cotton, and tea have under the same time period experienced upward trends. The production of cashew nuts are increasing rapidly and is now competing with coffee for the leading position as the cash crop that has the greatest export value in the country\(^3\). Sisal has on the other hand declined dramatically, the reason to that is most likely the substitution to Synthetic fibres (see Appendix 1). Reform-promoting export may be the reason to the increased production of the other cash crops; the performance of coffee is therefore surprising. The cash crops mentioned are no substitutes for coffee in Kilimanjaro as the natural growing conditions prevent this. Sisal is an exception since it is grown in the same environment, but as the diagram shows the production is steadily decreasing and we therefore not expect it to be favoured due to the cost of coffee. The five chosen food crops maize, cassava, wheat, paddy, and pulses all show increasing trends (see Appendix 2). Substitution from the cash crop coffee to one of these food crops could therefore be a possible explanation to the decline in coffee production.

\(^3\) In 1998 coffee was exported to a value of 76 400 million Tanzanian shillings and cashew nuts to a value of 74 700 million Tanzanian Shillings. (Basic data (2000), p. 10)


2.5 Market participants

To understand the structure of the coffee sector in Kilimanjaro, a presentation of the most important market participants and their functions from production level to auction level will be helpful.

Production- Smallholder farmers

The farmer, who we also call peasant, grows the coffee trees at his farm. Coffee is a very time consuming and labour intensive crop. It is a long-term investment to start producing coffee since it is a perennial. Normally it takes around four years from planting the coffee tree until it is productive. Gradually, the tree gets more productive until about the age of eight, and then it stays on the same level of productivity for 15 to 20 years if the conditions are favourable (Yawe (1996), p. 24). Careful maintenance such as pruning, weeding and spraying is necessary several times a year.

In Tanzania approximately 99% of the primary processing of the coffee is done at home while the rest are processed at central pulpiaries (CT (1999), p. 12). The coffee berries, also called cherries, are handpicked when wet processing is exercised which is the case in
Kilimanjaro. Careful attention is mandatory since only the red and ripe berries can be used. In order to harvest all the berries the farmer has to return to the same coffee tree several times during harvest season. After hulling the berries, the farmer separates the beans from the outer husk and the flesh with a hand-pulper together with a waste amount of water. Afterwards, the coffee beans are fermented, washed again and then sun dried. The bean is now called parchment coffee with is packed in bags and taken to the buying stand.

**Parchment buying- Primary societies and private buyers**

Parchment coffee is bought at the buying stand either by primary societies or by private buyers. A primary society consists of a group of farmers bound to the same geographical area. They take the coffee to the auction by using the co-operative unions as agents, while the private buyers have no middle hand. The private buyers are licensed companies that are allowed to buy parchment coffee, set up a curing company and sell coffee at the auction. We visited farmers in Kilimanjaro and since liberalisation they sell their parchment coffee both to the co-operative KNCU through the primary society and to different private buyers.

**Agency function- Co-operative unions**

The co-operatives take the parchment coffee to the curing factory owned by the co-operative unions. Prior to liberalisation, they acted as agents in providing the farmers with inputs through the Primary Societies. The co-operative in Kilimanjaro region is called Kilimanjaro Native Co-operative Union (KNCU) and the tradition of using KNCU is deeply rooted among the smallholders.

**Processing- Curing companies**

The private buyers take their parchment coffee to their private curing factories or the curing company owned by the co-operative unions. There are today four private curing companies in Kilimanjaro but only one “public” called Tanganyika Coffee Curing Company (TCCCo). At the curing company the parchment coffee is processed into clean coffee and the beans are graded by size and shape (MRoC (2000), p. 9). Further on in our essay we will only use the different names of the unprocessed and processed coffee when it is necessary to separate the terms.

**Auction- Tanzania Coffee Board**

The Tanzania Coffee Board (TCB) is a governmental institution that handles the licenses for coffee trading, issues export permits, establishes quality standards, provides information concerning the coffee industry and promotes the crop. Samples of cured coffee are taken to TCB from the curing factories for liquorizing, i.e. classification by taste into 17 grades of quality. The results are sent back to the curing companies with instructions for staking and bulking, i.e. preparation of the coffee for sale and export. An auction catalogue is compiled by TCB based on the results of the liquorizing classification and the physical grading done at the curing companies. This auction catalogue is, together with samples, sent out to all the licensed exporters before the auction at which the coffee is sold to the exporters. After the auction the exporters take the coffee from storage at the curing factories to the final destination, which can take a considerable amount of time.
3 Theory

In many developing countries the agricultural sector is the main employer and consists of mostly small family farms. Some of these peasants are among the poorest people in the world and are dependent on their crops for income and food supply. The peasant is considered a rational economic producer who wants to maximise his profit. A rational decision is the one that best serves the objective of the decision-maker and hence varies in different environments (Ingham (1995), p. 137). Developing countries tend to face a situation where problems such as unstable markets affect the farmers' situation and hence also their decisions. Prices are given to the small farmer since he only is a small actor with almost no possibility to negotiate. The small peasant is to a large extent dependent on factors that he cannot influence and therefore becomes highly vulnerable to the exogenous factors confronting him, such as weather, market failures and governmental policies. Frank Ellis presents one definition of the peasants:

"Peasants are households which derive their livelihoods mainly from agriculture, utilise mainly family labor in farm production, and are characterised by partial engagement in input and output markets which are often imperfect or incomplete."

(Ellis (1993), p.13)

To find out which factors that influence the farmer's decision about his production we first have to observe what kind of decisions he makes. Basic microeconomic production theory will be our guide here. However, this theory must be modified to fit into the situation confronting the peasant in a developing country, as Ellis also stresses in the definition above. Market failures will therefore be discussed, as they are disturbances in the environment.

3.1 The production theory

According to basic microeconomic theory, a farmer can as a producer vary his production pattern regarding input and output in different ways to achieve an optimal situation. Only a brief presentation will be carried out, so for further readings see for example Frank Ellis (1993) in "Peasant Economics" and the diagrams in appendix 3.

Product to product relationship
First the farmer observe the different kinds of output that can be received from a certain amount of input, for example how much coffee respectively maize he can get out of the same piece of land. This is measured by the production possibility frontier (diagram appendix 3.1).
Factor to factor relationship
Second the farmer compares the impact different combinations of inputs have on a fixed level of output, for example the amount of output coffee received by using different quantities of land and labour. Isoquants and iso-costs are used for the comparison (diagram appendix 3.2).

Input and output relationship
The last thing to lend consideration to concerning the farm is how much output the farmer can get from different amounts of one input, such as a labourer or a kilo of fertilisers. The production function determines this relationship (diagram appendix 3.3).

3.2 Market failures
In the reality most markets confront different kinds of market failures, which gives raise to bottlenecks and constraints in the society. Relevant to this essay are the market failures that many developing countries experience due to 1) high transaction costs due to poorly defined of property rights and missing markets, 2) uncertainty and risk, and 3) externalities. This section consists of an analysis of these failures.

3.2.1 Property rights and missing markets
Transaction costs are the costs of information, monitoring, negotiation, co-ordination and enforcement of contracts (Meier et al (2000), p. 359). To reduce these costs, social arrangements such as well-defined property rights and functioning markets have to be settled. Formal institutions and markets are further important for the economy in order for it to achieve economical efficiency and growth (Ingham (1995), p. 91).

Property rights are social arrangements that administrate the ownership, use and disposal of a factor of production, goods and services. Economic theory mentions three different kinds of property, real property such as land, financial property such as savings in the bank, and finally intellectual property which consists of creative products protected by copy rights and patents (Parkin et al (1997), p. 59). Markets are a link between producer and consumer and enable these to find the necessary information and do business with each other. A price exists on the market and consists of all possible information about the product that has been brought together by the market, and this reduces the transaction costs for the individual actors.

Poor property rights and imperfect markets are often strongly related. When no property rights exist, formal or legal markets will be non-existent and no formal prices exist. Two limitations facing formal lenders on an imperfect capital and land market are the lacking information regarding the potential client⁴, hence the transaction costs tend to be very high and second, they cannot accept non-monetary forms of collateral such as labour force or

⁴ Information about the clients’ background, the characteristics of the client or his current activities.
future output (Ray (1998), p. 533). Two kinds of informal institutions result from these problems.

The first is local arrangements. When no formal markets are present people borrow from informal private moneylenders. The bank does not know the peasant personally and may not accept the offered collateral, which can be future labour for example. Transaction costs are too high and so is the risk. To lend money in a bank is therefore not an option for the small farmer. A local private lender, on the other, hand knows the peasant and the value of his collateral and may be willing to give him credit (Ingham (1995), p. 148-149).

In the second arrangement, called sharecropping, the landlord allows the peasant to occupy and cultivate his land and in return he receives a certain share of the output. Sharecropping is suitable when information about the supply of labour is hard to get, under this system both the farmer and landlord gain if the production increases. Otherwise when a wage has to be paid, the landlord has to spend time ensuring that the peasant is working hard (Ingham (1995), p. 149-150). Sharecropping is often linked with credits through the already outlined relationship, which reduces the transaction costs. These loans are often production loans, which are tied to the purchase of inputs such as fertilisers and equipment (Meier et al (2000), p. 361).

3.2.2 Uncertainty and risk

Peasants in developing countries tend to experience a situation with higher uncertainty than in most developed countries due to, for example, the weather in the tropics, which is more varied than in the temperate zones, more unstable markets, and often a more volatile political situation. Furthermore the economic situation for the peasant family may cause the outcome of an uncertain event to be the difference between survival and starvation. Uncertainty is also said to be more severe for agricultural production than for industry since the production cycle is longer and because agricultural output depends on natural factors such as weather (Ellis (1993), p. 82ff). In the table below the standard errors of Gross Domestic Product (GDP) for chosen countries are shown as an indicator on risk. The first three countries are industrialised countries and show less deviation in GDP than the two chosen Sub Saharan countries, which are dependent on the agricultural sector. Higher risk in the latter countries makes decisions about future long-term investments harder to make.

<table>
<thead>
<tr>
<th>Country</th>
<th>USA</th>
<th>France</th>
<th>Sweden</th>
<th>Tanzania</th>
<th>Uganda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Error</td>
<td>8,9</td>
<td>8,5</td>
<td>2,9</td>
<td>16,6</td>
<td>32,4</td>
</tr>
</tbody>
</table>

The introduction of the Structural Adjustment Programmes in developing countries has increased the risk and uncertainty additionally for the farmer. Prices tend to be more violable due to the liberalised market, the forecasts on future markets are more uncertain and the decisions the farmers has to make are influenced by these conditions. Risk is closely related to uncertainty but not synonymous to it. A definition of the two economic terms will be useful to help the reader to understand their impact on the farmer.

Uncertainty and risk refer to probabilities, which are numbers between zero and one that measure the possibility that a certain event will occur. Risk refers to situations where probabilities of outcomes of certain events can be estimated. For example when you toss a die, the probability of receiving a four is 1/6. The term uncertainty is used in situations where ascription of probabilities does not exist. This is the case of the farmer, whose profit depends on the weather although he can possibly not know what the weather will be like. However, in some situations, probabilities cannot be based on previous observations so instead the person’s feelings regarding occurrence will be a guideline. In such a situation the expected outcome is based on subjective probabilities. The peasant will then attach different degrees of risk to uncertain events that confront him according to his subjective beliefs on their occurrence. The latter definition is the one that should be used (Parkin et al (1997), p. 418).

3.2.2.1 Analysis of risk behaviour

The diagram below describes a production function with three possible output response curves that interplay with one single variable input, here purchased fertilisers. These response curves can also be called Total Value Production curves, TVP, which by definition are formed by the total output produced with a given quantity of fixed input (Parkin et al (1997), p. 228). Two possible events concerning weather can occur in our example, the weather will be "good" or the weather will be "bad".
Figure 2. Risk behaviour

Source: Ellis (1993), p. 87

\begin{align*}
\text{TVP}_1 &= \text{the Total Value Product response to increasing the level of fertiliser input in a "good" year.} \\
\text{TVP}_2 &= \text{the Total Value Product response to increasing the level of fertiliser in a "bad" year.} \\
\text{E (TVP)} &= \text{the Expected Total Value product given the farmer's subjective views about the likelihood of occurrence of "good" and "bad" seasons.}
\end{align*}

The latter is an expression of the possible events attached to the subjective probabilities of the peasant's personal expectations. Where \( P_1 \) is the subjective probability of a "good" year, and \( P_2 \) is the subjective probability of a "bad" year.

\[
\text{E(TVP)} = P_1 \ast (\text{TVP}_1) + P_2 \ast (\text{TVP}_2)
\]

By adding the Total Factor Cost, TFC, to the diagram, the impact of efficiency according to risk behaviour can be calculated. TFC increases as more fertilisers are used. The diagram shows three alternative operating positions. A farmer acting at input and who uses \( X_1 \), is described as risk-taking, because he is willing to take the chance of getting the highest possible profit on TVP. If the farmer instead uses \( X_2 \) he is said to be risk-averse since he prefers to calculate safety using a worst-case scenario. A risk-neutral peasant operates on an input use of \( X_e \). His makes his decision on a balanced estimation of a "good" and "bad" year.
3.2.2.3 Consequences for the society

Former research on peasant behaviour stresses some effects on the production decision resulting from uncertain events. The first conclusion is that peasants in developing countries are risk averse. Consequently the production takes place at an inefficient level of resources where the marginal product exceeds the marginal cost (see appendix 3). Hence, the decisions are not optimal for the peasant. Second the peasant needs to secure food supply over the year, which result in a system of mixed cropping. This tends to increase the farmer's food security rather than maximise his profit. Third, there is an impact on agricultural growth as the risk averse peasants tend to show an unwillingness or reluctance to adopt innovations. Long-term irreversible investments tend to decrease as risk increases. This is closely related to lack of information and its defectiveness. Market information about innovations and agronomic practices are imperfect in many developing countries and distort the peasant's decision.

3.2.3 Externalities

Externalities arise when an economic activity leads to benefits (positive externalities) or costs (negative externalities) to others than the one who performed the action. According to Ray (1998, p. 155-159) social norms and status quo generate externalities and these affect the development path.

History and traditional activities create social norms that affect the society in a conservative way. A first example is that social norms influence people and decide what is acceptable and not. Farmers in a village with for example an old coffee tradition may expect the individuals to stay with this crop. The first one to try something new by breaking the production pattern takes the risk of being frozen out. Second, have slow changes and innovations in the production a negative effect on productivity, which influence the future outcome. No one wants to be the first pioneer adopting new technologies and hence take the cost when he knows that everyone else will get positive externalities from his action. The adoption of new technologies gives his neighbours useful information and reduces their uncertainty about the new invention. New information in these traditional societies therefore tends to affect the way the farmer assimilates the new ideas and how he incorporates the information in his production decisions.

History plays an important role in creating status quo, which often determines the success of a new policy. A new policy that is implemented in the country may have both gainers and losers, even though the overall society may benefit. It is important to compensate the losers in order to prevent a policy reactionary environment, but there are at least three problems concerning this payment of compensation. First, the losses and gains for the individuals are often hard to quantify. How should a farmer be compensated for having to move from his traditional farm because of the new irrigation system built in the village? Second, sometimes the winners and losers are not that easy to separate. This may for example be the case when introducing free trade where it is uncertain which sectors will succeed and thus gain on the international market. The third problem is concerning consistency. It may be hard to know exactly who the winners and losers are before and during the implementation of the new
policy, and compensation after the new project has taken place is often hard to carry out. Hence, the losses to some individuals are not made up for. An example is liberalisation on a market where the single gainers and losers are hard to forecast before implementation. Finally we conclude that if these compensations not are carried out, the future implementation of new projects may be influenced negatively because of the attitudes of the individuals and status quo is hence established.
4 Estimation of supply response

The farmer as a rational producer is assumed to react on prices and other exogenous factors. Marc Nerlove elaborated his theory about the relationship concerning supply elasticities for corn, cotton and wheat in the 1950’s. His research on this field of the dynamics of supply was originally presented as a doctoral dissertation in 1956 and then published in a book in 1958.

4.1 General supply response model

The general supply response model for producing a quantity of a certain crop, \( q \), is a function of price, \( p \), and other explanatory variables, \( z \).

\[
Q = f(p, z)
\]

When estimating supply response in relation to changes in prices there are two major problems with the general supply response model. First, the farmer is assumed to make decision about the production based on the actual price, i.e. the price for the crop at the time of planting. This time lag problem is solved in the Nerlovian model by letting the supply response depend on the expected prices over time. Second, the changes in price expectations may involve reallocation of variable factors. Therefore the observed quantities are not always the same as the desired ones and the Nerlovian supply response model (1956, 1958) stresses the importance of specifying these adjustment lags explicitly (Sadoulet et al (1995), p. 86).

4.2 Nerlove’s supply response model

The general Nerlovian supply response model is formed to explain for instance the desired yield, area, or output, \( q^d \).

\[
q^d = \alpha + \beta_1 p^e + \beta_2 z_t + u_t
\]

The expected price, \( p^e \), is a vector of relative factor prices for the selected crop, other crops and input factors. Shifters are denoted \( z_t \) and consist of private and public fixed factors and truly exogenous variables. The vector of unobserved random variables, which affects the desired output, \( u_t \), has an expected value of zero. \( \alpha \) is the intercept and \( \beta \) are the long-run coefficients of supply response. The variables of our extended regression below are presented logarithmically and \( \beta \) therefore express the elasticity.
Adaptive expectations are calculated in Nerlove's supply response model by using this equation:

\[ P^s_{t} - P^e_{t+1} = \gamma (P_{t-1} - P^e_{t+1}) + w_t \quad 0 \leq \gamma \leq 1, \text{ or} \]

\[ P^e_t = \gamma P_{t-1} + (1 - \gamma) P^s_{t+1} + w_t \]  

(3)

The peasant might adjust expectation as a fraction, \( \gamma \), based on the miscalculation in the previous period between the actual price and expected price. The price, \( P_{t-1} \), is the prevailing price at the time of planting. The adaptive-expectations coefficient is \( \gamma \) and \( w_t \) is a random variable with zero as the expected value.

The difficulties of predicting an accurate future price often results in a necessary adjustment afterwards. Full adjustment of the output level is often a problem with this model, since immediate reallocation between the variables not is possible in the short-run. The actual desired adjustment of output may only be a fraction, \( \delta \), representing the partial adjustment coefficient. \( q_t \) is the actual desired output, area, or yield and \( v_t \) is a random variable with zero expected value.

\[ q_t - q_{t-1} = \delta (q^d_{t} - q_{t-1}) + v_t \quad 0 \leq \delta \leq 1 \]  

(4)

Since \( P^s_t \) and \( q^d_t \) are not observable, we can eliminate them and get a reduced equation (5) from the equations (2), (3) and (4) by substituting from equation (2) and (3) into equation (4).

\[ q_t = \pi_1 + \pi_2 P_{t-1} + \pi_3 q_{t-1} + \pi_4 q^d_{t-1} + \pi_5 z_t + \pi_6 z_{t-1} + \epsilon_t \]  

(5)

Where:

\[ \pi_1 = \alpha \delta \gamma, \]
\[ \pi_2 = \beta_1 \delta \gamma, \] the short-run coefficient (elasticity) of supply response,
\[ \pi_3 = (1 - \delta) + (1 - \gamma), \]
\[ \pi_4 = -(1 - \delta)(1 - \gamma), \]
\[ \pi_5 = \beta_2 \delta, \]
\[ \pi_6 = -\beta_2 \delta (1 - \gamma), \]
\[ \epsilon_t = v_t - (1 - \gamma) v_{t-1} + \delta u_t - \delta (1 - \gamma) u_{t-1} + \beta_1 \delta w_t \]

This simplified form is overidentified since there are six reduced-form coefficients (\( \pi \)-coefficients), but only five structural parameters (\( \alpha, \beta_1, \beta_2, \gamma \) and \( \delta \)). To receive a sole solution we have to imply a non-linear restraint on the parameters:

\[ \pi_6^2 - \pi_4 \pi_5^2 + \pi_3 \pi_5 \pi_6 = 0 \]
The extended model should be estimated using non-linear, maximum-likelihood techniques. Structural coefficients can be solved with the following equations:

\[ \delta^2 + (\pi_3 - 2)\delta + 1 - \pi_3 - \pi_4 = 0, \]
\[ \gamma = 1 + \pi_4 / (1 - \delta), \]
\[ \alpha = \pi_1 / \delta \gamma, \]
\[ \beta_1 = \pi_2 / \delta \gamma, \text{ the long-run coefficient (elasticity) of supply response,} \]
\[ \beta_2 = \pi_3 / \delta \]

The short-run elasticity of supply is \( \pi_2 \) and the long-run elasticity is \( \beta_1 = \pi_2 / \delta \gamma \). Since both \( \delta \) and \( \gamma \) are fractions and have to be smaller or equal to one, the long-run supply response exceeds the short-run supply response (Sadoulet et al. 1995, p. 86-88).

### 4.2.1 Criticism of Nerlove’s supply response model

The main criticism towards Nerlove's supply response model is that the model was carried out as a doctoral thesis back in 1956 and that the model is based on agricultural commodities grown in the United States of America. We assume that the age of the model together with the differences in agricultural situations between industrialised and developing countries may affect the usage of the theory. Our quantitative estimation of the model below is based on the main ideas from the Nerlovian supply response model but applied on the situation facing the peasant in Kilimanjaro in a limited time period between 1983 and 1998.
5 Quantitative analysis

After the description of the theory about production decisions and the Nerlovian supply response model, our study on smallholders in Kilimanjaro will now be applied to the theory. Quantification of factors influencing the farmer in his decision will first be discussed and classification into the quantitative analysis (presented in this chapter) and qualitative analysis (presented in chapter 6) will be done. The special treatment of coffee as a perennial crop in a quantitative supply response model will thereafter be discussed. Next the sources of the data that our regression model is based on, the time demarcation and the way the variables will be used will be presented. Finally we present our regression results and discuss them.

5.1 Quantification of factors influencing the farmer

Variables affecting the farmer in his decision concerning his production are sometimes hard to quantify. We have therefore chosen to measure the variables for which we have been able to find statistical data. The other factors will instead be qualitatively analysed in the next chapter.

Figure 3. Variables influencing the farmer

<table>
<thead>
<tr>
<th>Quantified variables:</th>
<th>Qualitative variables:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Price for coffee</td>
<td>• Information, know how</td>
</tr>
<tr>
<td>• Price for a substitute</td>
<td>- education, norms, research</td>
</tr>
<tr>
<td>• Price for chemical inputs</td>
<td>• Capital availability and price</td>
</tr>
<tr>
<td>• Weather</td>
<td>- labour availability and price</td>
</tr>
<tr>
<td>• SAPs</td>
<td>• Land availability, quality and price</td>
</tr>
<tr>
<td>• Output previous year</td>
<td>- irrigation</td>
</tr>
<tr>
<td>• Other factors</td>
<td>• Institutional changes</td>
</tr>
<tr>
<td>- infrastructure, technological changes, future expectations et cetera</td>
<td></td>
</tr>
</tbody>
</table>

THE FARMER
Our regressions that measure the supply response on the production of coffee consist of variables that we have quantified. We have found statistics on the output, the real producer prices for coffee and a substitute, and the real price ratio between coffee and a chemical input. Dummies will be used for measuring weather conditions and the effects of SAPs. Other factors include infrastructure, technological changes, future expectations and et cetera.

Theoretically, information and know-how could be measured, for example, as number of visits from extension workers, number of newspapers read by the farmers, and rate of literacy. Investments put into coffee research annually could be a measurement for research. However, a problem would be to quantify the annual effects for the individual farmer. Annual household budgets can provide data on available informal and formal capital and its costs for the farmers; registers in banks would also help us find the formal supply to the farmers. Labour is not seen as a restricted factor in the rural areas because of the high rate of unemployment. However, amount of family labour used can partly be measured by an analysis of the school attendance and find out if there are short falls of children during harvest. Wages are often not official and barter is often practiced, household budgets may be a source of finding this kind of data. Area under coffee in our region would express the land availability and the quality could be measured geologically with a classification on the base of soil nutrition. A formal price of land does not exist due to the lack of property rights and household budgets may again be the solution. Irrigation can be quantified through the amount of farmers that have availability or not to irrigation. Institutional changes will be quantified through a dummy in the regression, but we will also qualitatively analyse the effects of a part of the Structural Adjustment Programmes, namely the institutional changes resulting from the liberalisation in the coffee sector. Due to the lack of data and the limitation of our essay, as just being an essay for a bachelor degree, we decided not to quantify these factors.

5.2 Supply response and perennial crops

Modelling the supply response of perennial crops such as coffee is considerably more complicated than in the case of annual crops. This is due to the fact that the supply of a perennial crop is not only influenced by decisions made in that particular year but also by investments in previous years (Nyachiro (1997), p. 61). According to Askari and Cummings (1976, p. 219-220) a perennial crop requires special treatment in the nerlovian supply response model. Crops that grow on trees, such as coffee, should be lagged back to include the years the crop needs to first be productive, j (in our case approximately four years) and another k years until full maturity (about another four years for the arabica coffee tree). Despite this fact we have chosen to lag the price only up to two years. We justify this statement by the lack of data and the fact that previous authors also have excluded this fact, for example is it the case in the study “Agriculture in Tanzania Since 1986, follower or leader of growth?” published by the government of Tanzania et. al (2000).
5.3 Data on the quantitative variables

We have used secondary data on the Kilimanjaro region in our regression analyses. Most of our statistical data origin from governmental institutions such as the Ministry of Agriculture and Co-operatives (price for maize), Ministry of Communications and Transport (rainfall), Tanzania Coffee Board (production, price for coffee) and the Economic Research Bureau at the University of Dar es Salaam (price for fertilisers 1983-1990). This situation with limited sources is caused by the severe problem in finding data; the reader should therefore keep the origin and the eventual biased effect in mind. Other sources for our statistics have been the Tanzania Fertiliser Company Limited, where we found data on prices of fertilisers from 1991-1998. Production of coffee is computed in tonnes clean coffee. Producer prices for coffee, maize, and prices for fertilisers are quantified in Tanzanian Shillings (TSh) per kilogram. The classification for the weather dummy, i.e. what a normal amount of rainfall is, has been done based on information from people with great knowledge on coffee but may be seen as a suggestion of grading. International organisations, such as the World Bank and IMF have some data available but it is not specified on regions, which we are in need of. Non Governmental Organisations and private companies may also have data but we did not gain access to that.

We have chosen to use time series data between 1983 and 1998; the reason to our choice of time period is because it covers;

- a period before the introduction of the Structural Adjustment Programmes in 1986,
- the first years after implementation of the programmes and
- the first years after liberalisation in the coffee sector 1994/95, which was one of the parts in the SAPs.

Due to problems in finding data over time, the analyses do not cover all the years that we intended to cover.

All prices that we use are presented as real producer prices, which are deflated with the Consumer Price Index (CPI). We are aware of the fact that CPI might not be based on representative goods that reflect the farmer’s consumption pattern, but we will by purpose neglect this problem. We will further use logarithmed values for all variables except for the dummies. Lastly, all variables will not be used in the same regression because of problems with overall significance when using many variables. This is due to the small number of degrees of freedom resulting from in our case, only 16 observations. We will therefore present regressions with one constant and five explanatory variables and compare the results. Five chosen regressions will be presented in the analysis\textsuperscript{5}. Elasticity, sign, significance and conclusions of the results will thereafter be presented.

\textsuperscript{5} Further regressions are presented in appendix 5.
5.3.1 The regression variables

Nerlove suggests the use of prices and a variable “z” that consists of other exogenous factors as explanatory variables in the regression analysis. Our null hypothesis is that the following quantitative variables have an influence on the farmer’s production decision. The alternative hypothesis is that these variables jointly not influence the production.

Dependent variable - Output
Nerlove suggest the use of yields, area or output as a dependent variable in the supply response model. Since our objective is to find reasons to the decline in the coffee production, we will in our model use annual output in millions of tonnes for the Kilimanjaro region.

Explanatory variable – Crop prices
We will use producer price in our regressions mainly because of the poor relation between the farm-gate price and the world market price. The peasant is expected to respond to both present and former farm-gate prices. A higher price gives incentive to increase the output. Coffee is a perennial crop and investment decisions are therefore made in the long run, hence the change in price today may not have an influence on the production until after some years. Time lags will therefore be used. Overall price elasticities are consequently expected to be positive and to increase with the time lag due to the time adjustment.

The producer price for maize will be included to represent a possible substitute. When the price for maize increases, incentives to switch over from coffee to maize are enlarged. A negative relation will therefore be expected. Maize and coffee trees are grown on the same height and therefore demand the same spot of land. In Kilimanjaro it is common to grow maize on parts of the cultivated land to ensure food supply but this production can easily be extended for commercial purposes. The producer price for bananas will not be used in our regression, as we do not count it as a possible substitute. Bananas can easily be inter-cropped with both maize and coffee because of the difference in height, as is the case in Kilimanjaro.

Explanatory variable - Input prices
Chemical inputs aim to raise quality and productivity. Higher prices tend to reduce the usage and we therefore expect to have a negative relation. We will use a price-ratio for the cost of fertilisers related to the farm-gate price for coffee to emphasis changes in the cost of production. Price on fertilisers will represent the chemical inputs even though we are aware of the possible substitution with manure that in most cases already is available at the farm. The reason for our choice of input is inadequate data on other chemical inputs such as fungicides and insecticides. Fertilisers should be applied on the crop five times a year, and outcome is therefore expected the same year and hence the farmer is supposed to react on prices in year $t$.

Explanatory variable - Marketing incentives
Since 1986 Structural Adjustment Programmes have been implemented in Tanzania. One of the aims of these programmes is to raise the export in the country and hence the production of coffee. But on the other hand this variable also represents the increased risk and uncertainty followed by the reduction of monopolies and monopsonies together with the negative effects on production, which are results of decreased public expenditures followed by the
programmes. Thus the expected sign is unknown. To signify the introduction and forthcoming of the programmes we will use a dummy variable. A "zero" will assign the years before introduction and a "one" will represent years with SAPs. A time lag of two years will be used, which can be justified with two reasons. First, the SAPs were introduced in a period after the economic crises experienced in the country in late 1970s, and the turbulent situation may therefore have affected the responsiveness of the new policies. Second, the reforms were implemented gradually until the middle of the 1990s, and hence all objectives were not implemented directly.

**Explanatory variable - Weather**
The impact of weather on the production can be specified in many dimensions: rainfall, sunshine, temperature et cetera. Rainfall is the most important and fluctuating weather factor in Kilimanjaro and will therefore in our regression represent the weather. This variable can also be seen as a represent of the risk and uncertainty that faces the production. Our regression is based on annual data, which have led to neglection of seasonal variations. In the case of rainfall, two main periods of heavy rain are expected in Kilimanjaro each year, the short and long rains. If, for example, the short rains stay away but the long rains are heavy, the annual rainfall might be “normal” but the consequences for the farmer production may not be considered “normal”. Further is the amount of rain based on annual rainfall measured at Moshi weather station, which will has to represent the area Kilimanjaro due to the lack of data covering the whole region. Our results may therefore be biased. We will use a dummy to assign the bad years. A "zero" is seen as a normal year with 800-2000 mm annual and a "one" represent years of too much or too modest rain.

**Explanatory variable - Lagged output**
We aim to use lagged output to reflect the lags in adjustment for desired output. The farmer tends to expect the real level of output the year before to be the same level next year for the same area cropped. A positive relation is therefore expected.

**Explanatory variable - Time-trend**
To capture the long run effects on output due to for example infrastructure, technological change and future expectations, we will use a time-trend. We will assume that the technology and infrastructure will improve with time and have a positive relation to production. The trend is calculated as $e^{t_{\text{trend}}}$ and after logarithm has been used the first year in our analysis will have a trend value of 1, the following 2, ..., 16.

### 5.4 Regression results

The results of five chosen regressions are shown in the table below\(^6\). In this section these results will be analysed with emphasis on significance, expected sign and elasticity.

---

\(^6\) The choice of these regressions is based on the results and overall significance of our regressions. The other regressions can be found in appendix 5.
Table 2. Regression results

(1) \[ \ln y_t = 8.01 + 0.56 \ln pc_{t-2} - 0.07 \ln y_{t-1} - 0.60 \ln pm_t - 0.24 dW - 0.19 \text{trend} \]
\[
(3.44) \quad (2.00) \quad (0.02) \quad (2.21) \quad (4.97) \quad (3.07)
\]
\[ \text{AdjR}^2 = 0.59 \]
\[ \text{F- statistics (4,11) = 3.48} \]

(2) \[ \ln y_t = 7.04 + 0.61 \ln pc_{t-2} + 0.43 dSAP88 + 0.70 \ln pm_t - 0.37 dW - 0.24 \text{trend} \]
\[
(8.46) \quad (2.73) \quad (2.18) \quad (3.17) \quad (4.35) \quad (4.80)
\]
\[ \text{AdjR}^2 = 0.68 \]
\[ \text{F- statistics (4,11) = 5.36} \]

(3) \[ \ln y_t = 6.59 - 0.04 dW - 0.15 \text{trend} + 0.46 \ln pm_t + 0.37 \ln pc_{t-1} + 0.28 \ln pfert_t \]
\[
(4.72) \quad (0.28) \quad (4.09) \quad (1.86) \quad (2.11) \quad (1.83)
\]
\[ \text{AdjR}^2 = 0.60 \]
\[ \text{F- statistics (4,11) = 3.64} \]

(4) \[ \ln y_t = 7.09 + 0.19 \ln y_{t-1} - 0.12 \text{trend} + 0.42 dSAP88 + 0.28 \ln pc_{t-1} - 0.16 dW \]
\[
(2.94) \quad (0.81) \quad (3.71) \quad (1.79) \quad (1.58) \quad (1.62)
\]
\[ \text{AdjR}^2 = 0.60 \]
\[ \text{F- statistics (4,11) = 3.64} \]

(5) \[ \ln y_t = 7.36 + 0.63 \ln pc_{t-2} + 0.50 \ln pm_t - 0.05 \ln pfert_t + 0.67 dSAP88 - 0.24 \text{trend} \]
\[
(11.80) \quad (3.15) \quad (3.15) \quad (0.70) \quad (3.40) \quad (5.75)
\]
\[ \text{AdjR}^2 = 0.76 \]
\[ \text{F- statistics (4,11) = 8.07} \]

Note: Method for estimation is non-linear maximum likelihood. Note also that R^2 is not bound in [0-1] in non-linear regressions. T-values are shown in parentheses. Test for auto correlation will not be carried out since it is very complicated in the non-linear maximum likelihood and not required for this type of essay.

All regressions consist of one constant and five explanatory variables, number of observations are 16. The abbreviations used in the table are:

- \( \ln y_t \): logarithmic output of coffee in period t (tonnes)
- \( \ln y_{t-1} \): logarithmic output of coffee in period t-1 (tonnes)
- \( \ln pc_{t-1} \): logarithmic real producer price for coffee in period t-1 (TSh)
- \( \ln pc_{t-2} \): logarithmic real producer price for coffee in period t-2 (TSh)
- \( \ln pm_t \): logarithmic real producer maize for coffee in period t (TSh)
- \( \ln pfert_t \): logarithmic real price ratio between producer price for coffee and price for fertiliser in period t (TSh)
- \( dW \): dummy for weather
- \( \text{trend} \): logarithmic trend variable, \( e^{\text{trend}} \)
- \( dSAP88 \): dummy starting 1988 for the Structural Adjustment Programmes
The overall result

The regressions presented above are all overall significant according to the F-statistic\(^7\). Individually most variables also show significance at the 5% level\(^8\). Adjusted R\(^2\) varies between 0.59 and 0.76, which generally does not indicate a very good fit. However, the adjusted R\(^2\) is not bound into the [0-1] interval and generalisations should not be made. Prices for coffee lagged two years, producer price for maize, the dummy for SAP starting the 1988\(^9\) and the trend are significant in every regression where they are used. The price ratio between fertiliser and coffee is not significant in one regression out of two, neither is the producer price for coffee lagged one year. Further, the weather is not significant in two out of four regressions. However the t-value of 1.62 is very close to significance in regression 4. Output lagged one year is not significant in either of the regressions where it is present.

Five out of seven used variables are consequent in the sign in all regressions above. Despite this fact, the signs are not always those expected, as in the case of the price of maize and the trend. In the case of output lagged one year and the price ratio between fertilisers and coffee, the signs are not consequent.

The individual variables

In all but one regression (price lagged one year in regression 4) the price variables for coffee are significant. All price elasticities are in the long run positive, and increase with the time lag, hence elasticities for prices lagged two years exceed elasticities when prices are adjusted only one year\(^10\). Our results concerning price elasticities can therefore be said to be as expected and are therefore satisfying. This implies that the farmer is rational and sensitive to price changes.

The producer price for maize, as a substitute to coffee, is significant in all regressions but shows a positive sign contrary to our expectations, and this implies a raise in the production of coffee when the price for maize increases. This result is very confusing and we have not been able to find a logical explanation. The prices for coffee and maize do not experience the same trend, which otherwise would have been a possible reason. Another explanation could be that coffee and maize are intercropped; a higher price for maize would then give higher income that could be used to increase the output of coffee. However most coffee decisions are made on a long-term basis contrary to the case of maize, and the result on the output should not come in the same year.

The price ratio between fertilisers and coffee is significant in regression 3 but does not show the expected negative sign. This means that when the price of fertilisers increases in relation to the producer price of coffee, the production of coffee increases. In regression 5 the result is the reverse. The sign is the one expected but the variable is not significant. However, the

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\(^7\) F-statistic (4 explanatory variables, 11 degrees of freedom), gives a critical value of 3.36.

\(^8\) t-statistic (11 degrees of freedom), gives a critical value of 1.796.

\(^9\) SAP88 have in regression 4 the t-value 1.787, which is very close to 1.796 and we therefore count it as significant.

\(^10\) Elasticities for the price lagged one year are 0.28 and 0.37, elasticities for price lagged two years varies between 0.56 and 0.63.
elasticity is very low (0.05). The reverse results can possibly be explained by the way the fertiliser-coffee ratio interacts with other variables used in the same regression.

In regressions where the dummy for SAPs starting in 1988 is present, the variable has a positive sign and is significant in all of the four regressions where it occurs (see foot note 6). This implies that the positive effects on coffee production have exceeded the negative effects discussed in “2.2. Effects of the Structural Adjustment Programmes.”

The dummy for weather is significant in two out of four regressions and has the expected negative sign in all. The conclusion can therefore be drawn that the weather has an impact on variances in the production and the farmer is living in an uncertain environment.

Output lagged one year shows a very low negative elasticity in one regression and a positive elasticity in the other regression (-0.07, 0.19). The variable is not significant in either of our regressions. Coffee is as earlier mentioned a perennial crop that needs long-term investments and the elasticities are therefore expected to be low as our regression shows. However, the weather has an important impact on the production as seen above and fluctuations in annual rainfall may be the reason to low significance.

The negative sign on the trend variables suggests that variables that affect the production negatively have been left out. The variable is significant in all regressions where it is used. Possible explanatory variables for the result will be discussed in the qualitative analysis of the bottlenecks in the next chapter.

5.5 Conclusion of the regression results

The regression analyses above show that the farmer is rational and responds positively to both producer prices of coffee and the reform programmes. However, all variables were not significant and we therefore failed to reject the null hypothesis. The negative trend implies that important variables are missing, which we predict to be the qualitative factors mentioned earlier. These factors will be analysed in the following chapter.
6 Qualitative analysis

In this chapter we will try to emphasise the qualitative obstacles we found during our field study in Kilimanjaro. Many interviews form the foundation of this chapter and we have chosen not to quote the interviewed persons due to some requests from the individuals to remain anonymous. Our own reflections will also to some extent be included in this section.

Some of the bottlenecks result from market failures but governmental actions have also caused further bottlenecks. Problems with poor information together with disfunctioning markets for capital and land are examples of market failures that affect the coffee-growing peasants in Kilimanjaro. The government's aim to liberalise the coffee sector has to some extent rather increased than solved the problems. This environment confronting the small peasant has resulted in little or no re-plantation, a reduced quality of the coffee and lower yields. If these bottlenecks remain unsolved, the future for the coffee-producing smallholders in Kilimanjaro will be unpredictable.

6.1 Information and know-how

Lack of information and know how is a market failure that influences the peasant in the way he perceives the surrounding world, it also forms a base for the decisions he makes. Historical and traditional norms together with available education possibilities may disturb the assimilation of the information and the decisions will hence be affected. Further research is of great importance since it contributes with useful information and knowledge to the farmers.

6.1.1 Sources of information

Information reaches the farmer through three main channels according to the findings in the Farm Management Survey, FMS (1997)\textsuperscript{11}. The \emph{first} channel is through parents and other family members. Such information mostly concerns practices, such as how to grow coffee. Coffee farms are inherited in Kilimanjaro and traditional practices are taught out early to the children. All of the farmers we interviewed had parents who also had been coffee growers and lived in coffee growing villages. Interviewed farmers referred to the urbanisation as an important problem. Traditional knowledge about coffee is in danger of disappearing as the old generation passes away.

\textsuperscript{11} The Farm Management Survey was carried out in 1997 by the government in Tanzania and the European Commission in order to be a foundation for the Coffee Sector Strategy Study (1998).
A second channel consists of the extension workers that consult the peasant about for example new technologies and the proper use of chemical inputs. There have been strong criticisms of the overall extension service. What we consider to be the major problem is the lack of specialisation. Until 1985, extension officers that were specialised on exclusively coffee carried out all coffee extension (CfT (1999), p. 23). Today each extension worker has to work as a consultant for all kinds of agriculture and livestock; hence they possess no specialisation know-how on a specific domain. One result stressed by an employee at TCB is that the extension workers tend to be much more interested in livestock because of the faster payback, hence there is a more instant result of the consultation. A second problem with the extension service is that they are understaffed, 473 extension workers have to visit 139 290 coffee farms on top of the other farming households in the Kilimanjaro region (CSSS (1998), appendix F22). In addition to the small number of extension workers and big area to cover the poorly maintained roads contribute to the inefficiency. The most common form of extension service is the so-called “training and visit” system (T&V) in which groups of farmers are formed and trained in the villages. Each group consists of one key-farmer who receives information from an extension officer, which he then shares with other farmers in his group. The key farmer is kept up-to-date by meetings with the extension worker every two weeks. One of the interviewed key farmers stressed that the T&V system is not working because the state cannot force people to learn. Tanzania experiences movement towards a free market in many different sectors. One interviewed person employed by the government fears that the extension service also will also become private in the future. Smallholders will then have to pay for this service and a risk of neglection of the service would be present because of the economic situation that confronts the farmers.

The third channel of information is through media. The most common channel is the radio. Of the farmers we interviewed all claimed to posses a radio. Every Wednesday between 7.15 and 7.30 pm TCB goes on air. The target group is the coffee farmers, and the program consists of education on agronomic practice and problems. Different topics such as price trends, fertilisers use or coffee diseases are treated every week. Other forms of media such as television and newspapers are of limited use, especially in the rural areas where the distribution of newspapers is inadequate.

6.1.2 Education and norms

The problem with lack of information and know-how is not limited to the constraints in the three channels that are offered to them. History and norms cause people to act and react differently and these things together with governmental policies concerning education, affects the way a farmer assimilates information.

Coffee plays an important historical and cultural role in the Kilimanjaro region, where some trees are said to be more than 100 years old. All the interviewed farmers have always been coffee producers and say that they have coffee to thank for their children’s education, the building of their houses and their food supply every day. This strong tradition and the social
norms make the farmer conservative in the way he adopts new technology, switches over to a more favourable crop or breaks the pattern in another way.

In 1987 more than 90 % were literate due to large efforts put into education after the independence in the early 1960s. But problems in the economy resulted in a decline in the rate of literacy to around 70 % in the late 1990s (LF (1999), p 7). The situation in the agricultural sector is even worse, only 40 % of the head of the coffee-growing households in Tanzania had formal education 1995/96 (CPSR (1997)). Education affects all sectors in the economy directly or indirectly and policies directed towards increased education need to be implemented in Tanzania.

Tanzania is one of the few countries in the world that is experiencing a declining school attendance rate. The explanation we got from the farmers in Kilimanjaro was that they considered it be too expensive to send all their children to school, in some cases they could only afford to enrol the oldest child in school. There are no school fees in primary school but since the beginning of the 1990s the parents have to pay for the uniform and school material. In secondary school, where the student can choose to attend two or four years, the parents have to pay a school fee on top of the other expenses. Private schools are about seven times as expensive as the public schools and keep a higher standard; it is not unusual to have around 200 pupils in each class in the public schools. The low rates of school attendance and poor facilities have important effects on the future farmer’s ability to receive and absorb information and know-how.

Poor husbandry is severe and has many negative effects; it is a result of poor information and extension service, as well as illiteracy. For example, little or no inputs are used and sometimes inputs that are too old and have lost their effect are sprayed on the crop. The ability to recognise diseases, awareness of the importance of re-plantation and additional field practices such as weeding, pruning, and spraying are also to some extent lacking. Consequently, the poor husbandry results in lower productivity. Farmers’ skills and competence therefore need to be improved.

6.1.3 Research

Former studies have shown that agricultural research in developing countries has been a major contributor to economic growth. Research is a risky investment but the payoff is high. Ruvalcaba (1986) concluded that the rate of return on the research of maize in Mexico was 78% to 91% (DSFP (2000), p. 1-3). To remain competitive and to keep up with technical progress research is of great importance and Tanzania should develop this field.

Lyamongo is the research station in Kilimanjaro where education of extension officers and research takes place. One of the main objectives of the station is to increase farmers’ income by reducing the cost of production (CSSS (1998), appendix F1). Unfortunately the station seems to be run inefficiently and the European Commission has therefore recently withdrawn their financial support. One of the interviewed persons has written a report about the poor
situation at Lyamongo. He concludes that Lyamongo "is not client oriented and there is inadequate support to the coffee industry". The farmers interviewed expressed their desperation for increased research in order to fight the coffee berry disease and leaf rust, two of the major diseases threatening the coffee trees in Kilimanjaro. There is also a great need for new seedlings that have shorter pay back time than the ones used at present time. Further, the extension workers seem to lack adequate knowledge today and need more specialised and more frequent up date of their education. The fact that the two neighbouring countries Uganda and Kenya produce coffee under partly the same conditions open up for possibilities of cross boarder collaboration. According to our interviews, there seems to be a lack of interest of such co-operation today, but we think it would save both money and effort if a closer relationship could be developed between these countries and their research stations.

6.2 Capital

Capital is badly needed in Kilimanjaro because the farmers need to purchase new inputs and new seedlings to improve production. According to our interviews markets for capital are imperfect and the lack of capital is one of the major reasons to the low productivity of coffee in Kilimanjaro today. Demand and supply are not met on the market and the situation in Kilimanjaro today regarding both sides will be discussed in this section.

6.2.1 Demand for capital

In Kilimanjaro the smallholders’ marginal is modest due to the weak economic situation. The primary goal for the farmer is to have a sustainable cultivation on his farm and from the outcome be able to maintain life on a daily basis by ensuring that the family has access to food, healthcare and education. This goal has to be achieved despite the fact that the demand for capital cannot be satisfied by the supply that exists today. The price that the peasant is paid for his coffee is often so low that there is no room for either savings or investments. The smallholders are today paying more in order to produce than they earn on the crop (see appendix 6). We have divided the demand for capital into three parts based on theories in "Development Economics" by D. Ray (1998, p. 531-532). This is to make it easier to follow when examining the specific features of the demand for capital in the region our region.

During the whole process, from planting to the final sale the farmer needs working capital to finance ongoing production. The farmer depends on cash received from the sale of the harvest to purchase seedlings, chemical inputs and so on. During the work-intense periods, such as the time for spraying, weeding and picking, the farmers that we interviewed said that they sometimes hire neighbours as work force and they do not consider it to be expensive. Due to the high rate of unemployment it does not seem to be a problem to find labour in the rural areas. To lower the costs of working capital, some farmers in Kilimanjaro form groups where they help each other with work instead of paying salaries, i.e. barter. It is also common to buy different chemical inputs together in order to maximise the use of it. It is often sold in large
quantities that make it more profitable to go together and share the inputs before the expiry date.

The required capital for expansion or improvement of the farm is called fixed capital. The lack of new land that can be cultivated in Kilimanjaro makes it almost impossible to expand a farm (see 6.3 land). To reduce the start-up costs connected with fixed capital, some smallholders in Kilimanjaro share expenses when building new facilities and/or when purchasing new equipment. Improvements are most of the time dependent on the supply of capital, which is as mentioned before, a scarce resource. There are also many other complex dilemmas facing the improvement of the coffee plantation. The problem with the old stock of coffee trees in Kilimanjaro can be solved with re-plantation. But it can be hard to motivate a farmer to cut down a productive tree and confront a time period of about five years of unproductiveness when the new tree is growing. Even though the peasant might know that the new investment will pay back in higher production, the time lag and his tight economic situation most of the time prevents him from carrying out the new investment.

If something goes wrong and the peasant needs capital to finance temporary shortfalls, there is a need for consumption credit. The ultimate situation would be to have a smooth income throughout the year to match the short spending cycles. Unfortunately the income flow from coffee as a perennial crop is irregular and depends on many exogenous factors. Bad years in the production have to be covered by the farmer. One way to neutralise these external shocks is to practice mixed cropping as the peasants do in Kilimanjaro. Even though this system not is optimal for an increased coffee production, it is perhaps the only possibility for the small farmer.

The formal financial services that exist today are not facilities where the peasants can save the surplus during good years and then at a time of deficit withdraw or borrow money. The rural credit market has to be solved in alternative ways. According to the FMS, which is based on Tanzania as a whole and not only the region of our interest, 45% of the smallholders saved between 20% and 50% of their income in 1996. Out of the savings, 51% of the respondents held savings in cash while 21% saved in livestock, the remainders saved in a combination of them both. It is common in Kilimanjaro for the farmers to buy livestock due to the many areas where it can be used. If it is a cow, the peasant not only benefits from the milk as food for himself, he can also sell the milk on the market, or the whole cow in case of emergency. If the farmer saves in cash he might receive interest but he will not be able to benefit from the interest every day.

The FMS states that the primary source of credit was loan from neighbours and friends (50%) followed by co-operatives, relatives and finally financial institutions, the latter contributing to less than 5% of the total credit. The primary reasons for borrowing money was to be able to fund investments in the farm, pay school fees, buy food and pay medical bills. About 40% answered that they had used the loans entirely for coffee related activities (CSSS (1998), appendix F49). While writing this essay some people have commented that it is not hard to receive loans from the informal sector. But we are sceptical to this discussion because we do not think that these kinds of loans can meet the farmers' total demand.
6.2.2 Supply of capital

In Tanzania the banking system is weak and scattered. Despite the liberalisation of the banking system in 1991, which has increased the amount of banks operating in the country, the availability of banks in the rural areas has decreased. The new banks are situated in the urban areas, where the market for credit is larger with companies and better with wealthier clientele. The FMS states that the supply of credit is only able to meet around 2% of the coffee farmer demand (CSSS (1998), appendix F50). This concludes that liberalisation did not achieve its goal of improving capacity, efficiency and quality of loans.

After the nationalisation of the banking system in 1967, the National Bank of Commerce (NBC) became the primary source of rural credits. Loans were given to the large co-operative unions through Tanzania Coffee Marketing Board (TCMB) and inputs were purchased and handed out to the coffee farmers. But in 1993, the large portfolio of uncollectible loans made the financial situation extremely difficult, and together with the fact that the bank also had managerial constraints, this resulted in that the lending virtually ceased.

After the collapse of the NBC, the bank was divided in two, where one part kept the old name and aimed to operate with larger and commercialised customers in urban areas. The other part became the National Micro Finance Bank (NMFB), a new institution for clients with the need for short-term capital loans without collateral, which was established in 1997. It is a way of solving the situation when there is a problem of limited liability\textsuperscript{12}. Experiences in other countries have shown that it is possible to reach the poor with the system of micro finance, even without subsidies. The bank lends money to a group of farmers rather than individuals and demands the loan to be paid back before any of the members can take a new loan, even a loan in new group constellations. In that way the farmers carefully choose the members and have a higher incentive to repay the loan (Ray (1998), p. 579). However it is stated in one principle of the NMFB that no production loans be made to farmers, which make the bank unlikely to become a source of credit for the small coffee farmer in the nearest future.

The only institutional credit facility that provides rural service seems to be the Kilimanjaro Co-operative Bank (KCB), established in 1994. One of the targets for the KCB is to provide banking service to the agricultural marketing co-operative societies, i.e. Primary Societies. KCB also promotes the Savings and Credit Co-operatives (SACCOs), which are small member owned rural saving and credit societies. KCB lends money to the Kilimanjaro Native Co-operative Union, which distributes the capital to the primary societies that together with SACCOs provide the financial service. It is the unified bonds and goals of the members of the SACCO that combine the group, and it is common that the members in the primary society also are members in the same SACCO. The borrower places savings in an account connected to the primary society or the SACCO, and hence indirectly to KCB. These accounts work as

\textsuperscript{12} The limited liability situation is when a borrower either succeed and can repay the loan with a part of the money from the output, or fails with the consequence of neither getting output nor being able to repay. The impossible situation for the farmer creates an environment where the lender often demands collateral, which the borrower seldom has (Ray, (1998), p. 533).
guarantees when providing members with credit. The primary goal of the SACCOs is to promote the monetarisation of rural economies and it is considered to be the simplest form of financial intermediation. But there are problems concerning collateral, accept from the accounts, is the best and most common used collateral often the familiarity of the group.

According to our interviews, TCB is on their way to implement a project called "Coffee Developing Farm" (CDF) which will provide loans to the farmers. TCB aims to invest in farms that are ran by "...young innovative people characterised as good peasants that are respected and accepted in the society..." By providing these farmers with capital, TCB hopes to raise the investments in new seedlings as well as in more inputs. This will together with more supervision from extension workers raise the output on each tree from around 250 grams to 3 kilograms, according to goals of TCB.

People in Kilimanjaro, both employees at KCB and farmers, put a lot of hope in the SACCOs. The NGOs seem to be prepared to support SACCOs with their knowledge and experience. But the most important aspect is the financial status of the NGOs, as they often act as a security or as a quality guarantee of the project. Two problems facing SACCOs today are that they are treated as co-operatives rather than proper banking institutions and second, their existence is not yet well known. If these two obstacles are removed, maybe with the help from NGOs, we think that this might be a future solution to the problem of supply of capital for the farmers. The goals expected from CDF are very thrilling and we hope that TCB will implement this system soon, although the criteria's for receiving a loan tend to be discriminating.

6.3 Land

In Kilimanjaro, the market failure resulting from poorly defined property rights of land is crucial and a market for land is non-existent. Consequently the farmer cannot use land as collateral. Further, the small farms are getting smaller and smaller due to land scarcity and high population growth and so the farmer is becoming an even smaller actor on the market.

In Tanzania nobody can own land, instead the smallholders have a permit to rent land on a 33-year basis while the commercial farms i.e. estates have longer contracts of 99 years. The permit is issued by the Ministry of Agriculture and Co-operatives, but in order to apply for this permit the farmer also needs a recommendation letter from the village government. The system of land inheritance of land is complex in Tanzania, even though the farmer cannot own the plot he is cultivating he is still by tradition supposed to hand over a piece of land to each of his sons. The system is called a patrilineal clan-land inheritance system, which means that the land shall be inherited from father to son and be kept in the hands of the Kilimanjaro clan Chagga. The only way to increase the farm size in the long run is to find a totally untouched piece of land (public land) and apply for permission to cultivate it. Once the farmer has started to cultivate the land he has by a governmental rule occupational rights (ALP (1997), p. 64). If the government wants the peasant to give up the plot, the government has to compensate the peasant for the loss of tearing up the crops. Since there is no formal market
for land it is not possible to quantify land, in an accurate way and get a proper value. Consequently, it is impossible to use land as collateral to receive loans.

The scarcity of land is prominent in Kilimanjaro even though the urbanisation is increasing. The average farm size in the region is now only half of a hectare (MroC (2000), p. 6). Reasons can partly be sought in the land inheriting system and partly in the extremely high population density of the area (Temu (1999), p. 43). Food crops and residential establishments tend to outdo cash crops such as coffee. The lack of good farmland caused the government to take action around ten years ago, when they encouraged people by helping them financially to move to less populated farming areas. This aid is not given anymore since the government assumes that the peasant now is aware of the profitability of moving in order to increase land property and thereby production. Soil degradation is also an outcome of the heavy use of the land. Trees on the slopes of the mountain Kilimanjaro are cut done to become firewood, which results in diminishing nutrition of the soil. The population growth has also caused lack of water. Forty years ago there were 301 water sources such as river and streams in Kilimanjaro but now there are only 150 left according to Mr Ndossi at MoAC. There is no excess water left to be able to maintain any affordable or sustainable form of irrigation for the small peasant, hence when the water in the rivers is low the small farmers are prevented to act. The estates, on the other hand, have computerised pipelines in the ground equipped with small sprinklers that give water to the individual trees when it is needed.

Competing crops are a threat to coffee in the competition of land. The land used for the growth of coffee tends to be reduced and allocated to other crops. As shown in appendix 2 the area under food crops is increasing in Kilimanjaro. Maize, for example, has increased from 56 400 hectares in 1991/92 to 117 700 hectares in 1997/98 (109%) in Kilimanjaro, whereas the area under coffee has only increased from 242 060 to 246 000 hectares (1.6%) during the same time period in the whole country\(^\text{13}\) (BD (1998)). The southern new coffee growing regions of Tanzania have experienced an increase of cultivated area and have potential to expand even more, as land is not scarce resource there, according to interviews. We can therefore suspect the increase in area to come from these regions.

### 6.4 Institutional changes

Institutional changes concerning the coffee industry will in this section be emphasised with support of the changes in the coffee production chain. The liberalisation of the coffee market in 1994 was probably the most important part of the Structural Adjustment Programmes for the coffee industry since the reforms were aimed directly towards the coffee production sector and will therefore be in focus. One goal with the liberalisation was to eliminate the coffee market imperfections and introduce competition. Instead new problems were created, which have affected the production of coffee negatively.

\(^\text{13}\) Specific data on Kilimanjaro is not available.
6.4.1 Towards liberalisation

When the state owned Tanzania Coffee Marketing Board (TCMB) was established in 1984, they became an agent for the co-operative unions and were in charge of the auctioning of their coffee for export. TCMB also supported the co-operatives with inputs, which they distributed through the primary societies to the farmers on credit. The costs for these inputs were deducted from the final price received by the farmer. The unions, in 1989, became allowed to set the level of their interim and final payments to the farmers, although the government continued to announce the advance payment\(^{14}\). A high advanced payment in 1991/92 was required despite falling world market prices, which resulted in increased indebtedness for the co-operatives, and the ability for them to purchase coffee was reduced. The harsh economic situation for the co-operatives together with demand from IMF and World Bank called for liberalisation. In 1993 “Coffee Industry Policy Bill” was presented to the parliament\(^{15}\) and in 1994/95 the liberalisation on the coffee market started.

6.4.2 Barriers to entry

Even though the monopoly-marketing channel TCMB was replaced due to the liberalisation other barriers to entry still exists. Competition is limited by the fact that licenses are required for operation on the market. A private buyer who wants to operate on the coffee market has to apply for several licenses such as parchment buying, curing works, liquoring, warehousing and export license. Licenses are processed at different time of the year, and some licenses are prerequisites in order to be able to apply for others. This procedure is very time and cost consuming for the applicant, and in addition, he has to re-apply for renewal of each license every year (Temu (1999), p. 68). The whole system can be said to be overly bureaucratic, as it slows down the coffee flow, increases the costs and reduces the coffee revenues. As a consequence, the price received by the farmer is negatively affected and the incentive for the farmer to grow coffee is reduced.

\(^{14}\) Co-operatives had before liberalisation a policy of three-part payment, advanced, interim and final payment. Advanced payment was based on the world market price at the time of purchase at the buying stand, whereas interim and final payment depended on the quality and the value of the coffee set at the auction (CSSS (1998), appendix B8).

\(^{15}\) The main objectives were to (1) replace the TCMB with the new TCB, Tanzania Coffee Board, which should only have a regulatory role, (2) allow private buyers to operate and compete with the co-operatives on the market, (3) open up the curing companies for competition, and (4) the auction should be led by professionals chosen by the participants and therefore become more efficient. In 1994/95 the liberalisation was introduced on the coffee market. (TA (1994), p.124-125)
6.4.3 Parchment buying

Both before and under the liberalised coffee market the farmer sells his coffee at the buying-stand. The difference is that liberalisation permits competition between the former monopsony the co-operatives, and the private buyers already at the farm gate instead of first at the auction as before liberalisation.\(^{16}\)

In the first years after liberalisation many private buyers joined the market in the belief to being able to make a good business. The quality of coffee went down because almost everything that looked like coffee was purchased at the buying-stands in the belief of large revenues on the world market. Peasants were tempted to harvest too early, wet and dried beans were mixed that caused fungus. Market forces soon eliminated this practice and the number of private buyers was reduced.\(^{17}\) The private buyers today are mostly multinational companies with good knowledge about coffee and they are financially strong. As a consequence of the latter characteristic, co-operatives and private buyers do not operate under the same conditions. According to interviews the private actors receive loans abroad with very low interest rates (about 2-4\%), while the unions pay large amounts (about 20-22\%) of interest in the domestic banks. The private buyers are therefore able to invest in the small farmers and can in the long run gain through helping the farmers increase quality and production. According to some of our interviews, these buyers do not seem to have the intention to do so, hope is instead put on NGOs to come and help the farmers. The private actors also hold a stronger position since they have the ability of leaving the market fast and to substitute with coffee from other countries such as Kenya and Uganda. The reliance on the private buyers can therefore be questioned and many farmers tend not to trust them.

The former system with three-part payment included a long time lag between the first payment and the remaining two so the farmer had to wait at least six months until he finally was paid. The waiting for payment was compensated with two major advantages. First, the farmer got paid according to the attributes of his coffee. Quality was measured at the buying stands and an incentive to produce coffee with high quality was therefore provided.\(^{18}\) Coffee that did not meet the requirements could also be refused. Second, the peasant received inter-seasonal earnings, which smoothed out his income over the year. On the other hand the farmer took a risk due to, changes in world market prices and bad handling of his coffee that could result in lower quality. However, the risk was reduced to some extent by the government, which guaranteed minimum prices before the marketing session. Today no such guarantees exist. After liberalisation, private buyers came in and offered a single advanced payment with a consequence of less quality control. The same price is paid regardless to the effort the farmer has put on his crop. Due to a failure in paying the farmers in 1995/96, the co-operatives faced problems in contracting farmers, and to avoid loosing more market shares

\(^{16}\) The trade procedure is carried out by the primary societies as middle hands. The primary societies are members of the co-operatives.

\(^{17}\) In 1994/95 there were 40 licensed private buyers, who contributed with 30\% of all coffee, in 1996/97 the amount was reduced to 32 private buyers, but their share of the purchased coffee had increased to about 90 \% of the mild arabica coffee in Tanzania (CSSS (1998), appendix B8).

\(^{18}\) At the farm-gate, parchment coffee was quality graded into three groups "special", "number one" and "number two".
they introduced a single payment like their competitors\textsuperscript{19}. Now the buyer takes the risk of bad quality and price differences between farm gate and auction. One can argue that the buyer, according to his economic situation, can handle the risk better than the small farmer, and the system of payment at delivery are therefore better. On the other hand, this new system reduces the incentives to grow high quality coffee and the risk of bad quality therefore tends to be increased.

An extra bonus paid after the auction to the farmers who delivered coffee of a high quality might provide incentive to raise the quality. However, a problem is the identifying of individual smallholders’ coffee. A possible solution is to form farmer groups where the members have similar economic prerequisites and the same goals. Then they can bring greater quantities to the buying stand, which makes it easier to negotiate about the price and also easier to “earmark” their coffee in order to receive the extra bonus.

The expected outcome of the competition at the buying stands has, to a large extent, stayed away. According to interviews, the private buyers do not compete with the co-operatives and among themselves as expected, instead they tend to form themselves into price cartels and peg their price on a level just above the price offered by the co-operatives. Further, the small peasant sometimes has no real choice of choosing a buyer because of his weak economic situation. Farmers interviewed seem to prefer the co-operatives because of the strong tradition, but are sometimes forced to sell to private buyers to receive the higher payment. Lastly, the farmer’s weak negotiation position together with the lack of competition in the price setting makes the farmer reliant on the buyer to be able to sell his coffee on time.

Many interviewed persons stress the lack of replacement for the primary societies and indirectly the co-operative unions as suppliers for chemical inputs. When private buyers became allowed to operate on the market, the free rider problem made it impossible for the co-operatives to continue to provide inputs. If an actor provided inputs it would be uncertain if the coffee in the long run would be sold to that actor. More information and co-operation between the primary societies and the private buyers would make it difficult for defaulters to sell to alternative traders to avoid repayment for the inputs provided by another trader, and hence providing of inputs would be possible. Subsidies for fertilisers were deducted during the first years of the 1990s and the trend in usage is obvious.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total fertiliser consumption (Mt)</td>
<td>51249</td>
<td>49679</td>
<td>47854</td>
<td>36300</td>
<td>35900</td>
<td>27000</td>
<td>31267</td>
<td>38149</td>
<td>27826</td>
</tr>
</tbody>
</table>

Source: FAOSTAT database

\textsuperscript{19} The authors of this essay do still not know if all co-operative unions have left the system of part-time payment or if some unions still practice it.
In July 1997, the National Input Voucher Scheme (NIVS) was introduced in order to make the farmers purchase inputs. The farmer does not receive full payment for his coffee; a small part consists instead of a voucher, which he is supposed to exchange for inputs. The vouchers can only be used for buying inputs and the peasant receives vouchers for about 4% of the farmgate price, which in 1996/97 covered for about 20% of the inputs needed (Temu (1999), p. 49). The farmer is forced to pay the remaining cost with his own income from coffee. Hence, the system rather forces the farmer to save a part of his income as cash now contrary to the former system of credit. One can argue that the voucher system can be seen as a "patronising" system with the government trying to control the peasant and neglect the peasant’s own ability to make decisions. The voucher system works well to a certain extent but there are some problems with peasants in urgent need of cash that exchange their vouchers for money. This situation is especially common close to the Kenyan border where farmers have the option of crossing the border to by less expensive inputs due to the fact that the government of Kenya has kept the subsidies on inputs. An additional problem is the fact that the vouchers are based on past production and this gives no help to new entrants nor does it encourage expansion of the production, which would be the case when providing credits. Printing, distributing and insuring safety in transferring the vouchers further result in additional cost for the coffee industry as a whole.

6.4.4 Selling

Both private buyers and the co-operatives have to bring their coffee to the auction. Their coffee is referred as "private" and "public" coffee respectively. At the auction there is bidding between private buyers who also have a licence to perform export, pure exporters and the co-operatives. The latter can export but usually does not. Private buyers repossess their own coffee due to the fact that they have already committed to sell most of the coffee if not all of it abroad. Despite the fact that they are buying from themselves, they will agree to almost any price in the betting. It is extremely unusual to bet on "private" coffee because the only chance to win is to offer a "too" high price. It is only the small amount of "public" coffee that really participates in the bidding process.

The inefficiency of the coffee industry also reduces the incentives to stay on the coffee market in Tanzania. It appears that many interviewed people including private buyers are calling for a changed system. The auction today does not function well since there is no actual competition however the government claim that it is needed for the control.

6.5 Old trees, bad quality and low yields

We will in this section give a summary of the effects of the market failures and institutional changes above on the age of the trees, the quality and the productivity. If the smallholder coffee in Kilimanjaro is to have a future, these constraints need to be solved.
6.5.1 Old trees

As earlier stressed Kilimanjaro, as a coffee region with long tradition has many farms that consist of old trees that should have been replaced long ago. Capital is needed to buy the new seedlings and even more importantly, to have the financial back up during the period before the first harvest. Further, the land scarcity reduces the ability to put new seedlings on a new spot of land. Sadly, the fact is that the new private buyers do not help the farmers by investing in their re-plantation, even though they probably would gain in the long run. The old age reduces the yields and hence the production at the farm. According to the FMS (CSSS (1998), appendix C9) 24 % of the trees in Kilimanjaro are more than 50 years old. Important here is to keep in mind that the arabica tree reaches its productivity peak at the age of eight and then stays at that level of productivity for about 15 to 20 years depending on the soil, climatic conditions and husbandry practices (Yawe (1996), p. 24).

6.5.2 Quality

The quality of arabica coffee is falling in Tanzania as shown in the table below. We have not been able to find statistical data on the region Kilimanjaro, but the trend is most likely the same or even more downward sloping. This can partly be explained by the land scarcity in the region, which results in old trees, which are more vulnerable to disease. The liberalisation has eliminated the input credit to farmers, and the quality control at the buying posts has disappeared. The availability of credit seems to be modest and so are the incentives to raise the quality. Lynamongo research station is badly run and has financial problems that negatively affect the development of improved methods, and seedlings to raise the quality. Further, poor field practice and control, resulting from limited information and education, also contributes to the low quality.

Table 4. The decline in coffee quality in Tanzania

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 4</td>
<td>5.9 %</td>
<td>0.6 %</td>
<td>0.5 %</td>
<td>0.0 %</td>
<td>0.0 %</td>
</tr>
<tr>
<td>5 – 6</td>
<td>28.6 %</td>
<td>10.8 %</td>
<td>1.2 %</td>
<td>1.3 %</td>
<td>1.7 %</td>
</tr>
<tr>
<td>7 – 8</td>
<td>41.1 %</td>
<td>31.2 %</td>
<td>20.4 %</td>
<td>24.1 %</td>
<td>19.8 %</td>
</tr>
<tr>
<td>9 – 10</td>
<td>15.5 %</td>
<td>34.2 %</td>
<td>50.8 %</td>
<td>52.1 %</td>
<td>46.9 %</td>
</tr>
<tr>
<td>11 -</td>
<td>8.9 %</td>
<td>23.2 %</td>
<td>27.1 %</td>
<td>22.5 %</td>
<td>31.6 %</td>
</tr>
</tbody>
</table>


---

20 Liquoring class 1-4 consist of the beans with the highest quality, and class 11 and below are beans with very poor quality.
6.5.3 Yields

Yields are declining in Kilimanjaro as a result of the old age of trees and the bad quality described previously. The diagram below shows that the productivity in Kilimanjaro has fallen from 292 kg/ha in 1971 to 81 kg/ha 1998, which is a drop of 72%. According to our interviews, the productivity is higher on the other side of the boarder in Kenya, where arabica coffee is grown under almost the same conditions. The differences in productivity gives ceteris paribus the farmers in Tanzania less production and hence a lower income, which reduces their purchasing power. Consequently, the use of chemical inputs is further being reduced and so is the ability of re-plantation. The situation is a vicious circle that has to be broken, low yields mean low income, which leads to low quality and old trees, which gives even lower yields et cetera. Farmers in Kilimanjaro become less competitive on the world market because of these constraints.

Diagram 2. Average annual productivity in Kilimanjaro

7 Concluding remarks and policy recommendations

Since 1986 several Structural Adjustment Programmes have been implemented with one aim to raise the export. Despite these actions has coffee production, as the most important contributor to export earning, declined due to several constraints in the agricultural sector. We aimed to find these factors that influence the small farmer in his decision concerning the production and thereby find the reasons to the declining production. Our regressions, together with the qualitative analysis, have to a large extent answered these introductory questions. In this chapter these major constraints will be summarised and discussed. Policy recommendations will also be given.

Conclusions from the quantitative analysis
We found that producer prices for coffee had a positive relation with the output, which we had expected. A reduction of the middle hands would increase the price received by the farmer and hence give incentives to raise the production. A higher degree of competition at the buying stands would also bring up the prices.

Even though our regression demonstrated that the maize is not a substitute for coffee in the short run we might expect a substitution from food crops to export crops in the long run. This may be one of the explanations to the reduced production of coffee. Our diagrams in appendix 2 show an increasing trend for food crops, while coffee as a cash crop is declining diagram 1. Other studies have also emphasised this event of substitution, discussed in for example “Agricultural Supply Response in Tanzania: Has Adjustment Really Worked?” (Danielson (in press)).

Structural Adjustment Programmes were also found to positively have affected the coffee production; this implies that the positive effects including reduced trade barriers and raised producer prices have exceeded the negative effects due to raised uncertainty and risk. However, other cash crops have experienced an increasing trend in production contrary to the case of coffee and the positive effects do therefore seem to have had a larger impact on these crops, the reasons for this should be closer investigated.

Weather was significant in some regressions as a variable influencing the production. To help the farmer to maintain the production when the rain is modest, irrigation possibilities in the rural areas should be provided.

Conclusions from our qualitative analysis
Poor husbandry has resulted partly from the inadequate specialisation among the extension workers. More specialised education and continuous training for the extension workers are therefore called for to improve the husbandry. The best way would probably be to continue to have the education at the Lyamungo research station since the facilities already are there, even though the station has to be reorganised and modernised in order to function well. The ultimate solution would of course be to both offer more specialised education and to increase
the amount of extension staff in order to transform the extension workers into an effective group of consultants.

A research of higher quality is further needed to improve the production. Development of new cultivars, which combine high yields with decease-resistant species, is needed to replace the current stock of old trees. Our suggestion is cross border co-operation with the neighbouring countries Kenya and Uganda, which also are coffee growing countries facing the same coffee quality disturbances.

The infrastructure, including road network, media, and education is considered to be in a bad condition in the rural areas. Roads must be improved to become independent of adverse weather conditions. This would facilitate for the extension workers in providing their services and for the farmer when transporting his crop to the buying stands. Media distribution is also a problem in these areas and farmers risk to bet set behind from the society when information not reaches them. A related problem is the poor education availability and facilities that have resulted in declining rate of literacy. The government need to invest in education since it affects all sectors in the economy and is a milestone for growth.

One of the major problems resulting in bad quality, old trees, and low yields is the imperfect market for capital. The financial system in Kilimanjaro is severely set behind and the need for credit is urgent in order to invest in new equipment, re-plantation of the coffee trees and to purchase various chemical inputs. One suggestion to solve the problem would be to increase the support to the SACCOs in order to help them to expand, and to develop them to accepted credit institutes. Another solution would be to make the idea of micro finance a reality, even for production loans, supposable in the regime of the National Micro Finance Bank.

An official record over land ownership should be organised to solve the problem with the imperfect market for land. If the farmers have the possibility to own his land it would open up for a formal market for selling and buying of land. This would result in the possibility to increase the size of the farm and to raise the production.

The private investors have participated on the market since the liberalisation of the coffee sector in 1994. Unfortunately they are only participating in parchment buying, in processing, and at the auction, not in the production. It should be in their interest to help the farmers to improve the quality, re-plantation and hence the yields. In the qualitative analysis the diverse opinions about the meaning with the auction system were discussed, the private buyers consider the auction to be an unnecessary and bureaucratic institution while the government wants to keep the system for control. We do not have a clear opinion in this case, in one way we can agree with the people that want to reform the practise of the auction system due to the inefficiency but on the other hand we find it necessary to control the market to prevent buyers to take advantage of the small farmers. Our suggestions would be to skip the auction and move the betting procedure to the buying stand where the coffee should be judged on basis of the old farm gate quality system or to imitate the system used in Kenya where the private buyers can first enter the coffee market at the auction level. Governmental policies should aim to create healthy competition without exploiting the farmers. A working competition raises the producer prices and, as concluded in our regression, also the production.
We fear that if the obstacles facing the coffee industry today are not solved, the small coffee growers in Kilimanjaro will not be able to live from the coffee production. The trend towards more intercropping in order to assure food supply is already there, but the deep rooted tradition is keeping the farmers to hold on to coffee production in as large extent as possible. The estates on the other hand have facilities that assure higher productivity and their importance for the coffee production will most likely increase in the future. We strongly recommend the small farmers to create advantages on the market by forming a niche. Coffee in Kilimanjaro is today grown with little or sometimes no chemical inputs at all; this makes them eligible to market their coffee as ecological coffee. We think that this market will become bigger in the nearest future as we can see a trend towards a more enlightened consumer group that prefer to drink coffee brought up on less chemical substances. Another market that probably will open up more is the market for fair trade, especially now when the debt burden in the developing countries is in focus in the media. The peasants in Kilimanjaro are a representative group of farmers that could benefit from a fair trade system.
Appendix 1. Production of cash crops in Tanzania

1.1 Production of cashew nuts

Source: Tanzania Cashewnuts Board

1.2 Production of tobacco

Source: Tanzania Tobacco Board
1.3 Production of cotton

Note that the y-axis is kinked and starts at a value of 50000, not at 0.
Source: Tanzania Cotton Board

1.4 Production of sisal

Source: Sisal Estates
1.5 Production of tea

Note that the y-axis is kinked and starts at a value of 10000, not at 0.
Source: Tanzania Tea Board
Appendix 2. Production of food crops in Tanzania

2.1 Production of cassava

Note that the y-axis is kinked and starts at a value of 800000, not at 0.
Source: Crop Monitoring and Early Warning Unit, Ministry of Agriculture and Co-operatives

2.2 Production of wheat

Note that the y-axis is kinked and starts at a value of 40000, not at 0.
Source: Crop Monitoring and Early Warning Unit, Ministry of Agriculture and Co-operatives
2.3 Production of pulses

Note that the y-axis is kinked and starts at a value of 200000, not at 0.
Source: Crop Monitoring and Early Warning Unit, Ministry of Agriculture and Co-operatives

2.4 Production of paddy

Source: Crop Monitoring and Early Warning Unit, Ministry of Agriculture and Co-operatives
2.5 Production of maize

Note that the y-axis is kinked and starts at a value of 1000000, not at 0.
Source: Crop Monitoring and Early Warning Unit, Ministry of Agriculture and Co-operatives
Appendix 3. Production decision curves

3.1 Production possibility frontier

3.2 Isoquant and iso-cost

3.3 Production function
### Appendix 4. Variables used in the regression

<table>
<thead>
<tr>
<th>Year</th>
<th>CPI</th>
<th>Output of coffee (Mt)</th>
<th>Real price for coffee (TSh)</th>
<th>Real price for maize (TSh)</th>
<th>Real price fertiliser (TSh)</th>
<th>Dummy SAP88</th>
<th>trend</th>
<th>Dummy weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>55.10</td>
<td>12544</td>
<td>41.51</td>
<td>3.99</td>
<td>2615.50</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1984</td>
<td>75.00</td>
<td>16340</td>
<td>39.57</td>
<td>5.33</td>
<td>6700.50</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1985</td>
<td>100.00</td>
<td>16070</td>
<td>56.17</td>
<td>5.25</td>
<td>6700.50</td>
<td>0</td>
<td>3</td>
<td>0</td>
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<tr>
<td>1986</td>
<td>132.40</td>
<td>8845</td>
<td>44.36</td>
<td>4.76</td>
<td>8310.00</td>
<td>0</td>
<td>4</td>
<td>0</td>
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<tr>
<td>1987</td>
<td>162.30</td>
<td>10571</td>
<td>59.97</td>
<td>5.05</td>
<td>10803.00</td>
<td>0</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>1988</td>
<td>193.50</td>
<td>15436</td>
<td>77.59</td>
<td>4.85</td>
<td>10803.00</td>
<td>1</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>1989</td>
<td>219.30</td>
<td>10622</td>
<td>70.21</td>
<td>5.02</td>
<td>10803.00</td>
<td>1</td>
<td>7</td>
<td>1</td>
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<tr>
<td>1990</td>
<td>255.10</td>
<td>11864</td>
<td>60.76</td>
<td>5.10</td>
<td>12950.00</td>
<td>1</td>
<td>8</td>
<td>0</td>
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<tr>
<td>1991</td>
<td>283.80</td>
<td>12147</td>
<td>81.04</td>
<td>10.57</td>
<td>11945.03</td>
<td>1</td>
<td>9</td>
<td>0</td>
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<tr>
<td>1992</td>
<td>305.60</td>
<td>14455</td>
<td>103.40</td>
<td>16.37</td>
<td>11092.93</td>
<td>1</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>1993</td>
<td>330.90</td>
<td>9837</td>
<td>254.16</td>
<td>19.49</td>
<td>34530.37</td>
<td>1</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>1994</td>
<td>440.60</td>
<td>7866</td>
<td>272.38</td>
<td>15.47</td>
<td>25923.74</td>
<td>1</td>
<td>12</td>
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<tr>
<td>1995</td>
<td>565.60</td>
<td>15683</td>
<td>212.16</td>
<td>12.64</td>
<td>27705.09</td>
<td>1</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>1996</td>
<td>684.40</td>
<td>10463</td>
<td>118.89</td>
<td>12.79</td>
<td>30391.58</td>
<td>1</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>1997</td>
<td>794.10</td>
<td>3653</td>
<td>188.89</td>
<td>11.50</td>
<td>24757.59</td>
<td>1</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>1998</td>
<td>895.90</td>
<td>4465</td>
<td>145.11</td>
<td>13.03</td>
<td>20761.25</td>
<td>1</td>
<td>16</td>
<td>0</td>
</tr>
</tbody>
</table>

**Sources:**
- Price Coffee: TCB
- Price fertiliser: Economic Research Bureau (1983-1990),
  Classification made on basis of people with great knowledge (mainly Mr Ndossi at MoAC, Moshi)

**Note:**
All prices are in real prices. When used in the regression all prices and the production were logarithmed.
A ratio between price for fertiliser and price for coffee was used in the regression.
Appendix 5. More regression results

(6) $y_t = 10,67 - 0,23 \ln pc_t + 0,15 \ln pc_{t-1} + 0,00 \ln pfert_t - 0,24 \ln pc_{t-2} + 0,04 dW$

\[\begin{align*}
&\text{AdjR}^2 = 0,29 \\
&\text{F- statistics (4,11) = 0,88}
\end{align*}\]

(7) $y_t = 8,18 - 0,13 \text{trend} + 0,06 y_{t-1} + 0,35 \ln pc_{t-2} + 0,30 dSAP89 - 0,18 dW$

\[\begin{align*}
&\text{AdjR}^2 = 0,53 \\
&\text{F- statistics (4,11) = 2,72}
\end{align*}\]

(8) $y_t = 8,88 - 0,37 \ln pc_{t-1} + 0,64 \ln pc_{t-2} + 1,14 \text{trend} + 0,17 dSAP88 - 0,26 dW$

\[\begin{align*}
&\text{AdjR}^2 = -1049,80 \\
&\text{F- statistics (4,11) not available}
\end{align*}\]

(9) $y_t = 7,28 + 0,02 \ln pc_t + 0,37 \ln pc_{t-1} + 0,32 \ln pc_{t-2} - 0,16 \text{trend} + 0,13 \ln pm_t$

\[\begin{align*}
&\text{AdjR}^2 = 0,56 \\
&\text{F- statistics (4,11) = 3,12}
\end{align*}\]
Appendix 6. Estimation of the production costs

Calculation estimated by an interviewed farmer

<table>
<thead>
<tr>
<th>Cost of production</th>
<th>(one year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spray for insecticides</td>
<td>22 000 Tsh (for three times)</td>
</tr>
<tr>
<td>Spray for fungicides</td>
<td>132 000 Tsh (for six times, incl. labour)</td>
</tr>
<tr>
<td>Pruning</td>
<td>45 000 Tsh (three times)</td>
</tr>
<tr>
<td>Weeding</td>
<td>30 000 Tsh (three times)</td>
</tr>
<tr>
<td>Harvesting</td>
<td>18 000 Tsh</td>
</tr>
<tr>
<td>Pulping</td>
<td>10 000 Tsh</td>
</tr>
<tr>
<td></td>
<td>=257 000 Tsh</td>
</tr>
</tbody>
</table>

**Revenue**

| 300 kg* 500              | =150 000                    |

**Profit**

-107 000 Tsh/ year (2000)

Consequently this estimation shows that the costs are higher than the revenues, hence the farmer receives a negative profit.
References


Temu Anna. Emperical Evidence of Changes in the Coffee Market after Liberalization: a Case of Northern Tanzania. Submitted in partial fulfilment of requirements for the degree of Doctor of Philosophy in Agriculture Economics in the Graduate College of the University of Illinois at Urbana-Champaign, United States of America, 1999.


Interviews

2000-09-14 Mrs M. Urasa, Program Assistant Officer, Embassy of Sweden, Dar es Salaam.
2000-09-14 Mr J. Mtui, Bookkeeper, Embassy of Sweden, Dar es Salaam.
2000-09-18 Mr Mabele, Director, Economic Research Bureau, the University of Dar es Salaam, Dar es Salaam.
2000-09-19 Mr M.J. Munissi, Private Sector Development Desk Officer, Ministry of Agriculture and Co-operatives, Dar es Salaam.
2000-09-19 Prof S.M. Wangwe, Executive Director, the Economic and Social Research Foundation, Dar es Salaam.
2000-09-25 Mr P. Kimaryo, Public Relations Officer, Tanzania Coffee Board, Moshi.
2000-09-27 Mr S. Kyambile, Director of Finance, Tanzania Coffee Board, Moshi.
2000-09-28 Mr F.S. Mpangile, Director of Operation & Planning, Tanzania Coffee Board, Moshi.
2000-09-28 Anonymous, Employee, Tanzania Fertiliser Company
2000-09-29 Mr A.P. Saruma, Branch Manager, Tanganyika Farmers Association, Moshi.
2000-10-02 Dr. S. Ponte, Center for Development Research, Moshi.
2000-10-02 Mr F.S. Ole, Chief Engineer, Tanganyika Coffee Curing Company ltd, Moshi.
2000-10-02 Mr L.A. Mandara, Employee, Tanganyika Coffee Curing Company ltd, Moshi.
2000-10-03 Mr J.E. Mkamba, Employee, Coffee Management Unit, Moshi.
2000-10-03 Mr Ndossi, Coffee Inspector, Ministry of Agriculture and Co-operatives, Moshi.
2000-10-04 Mr Kessey, Extension Worker, Ministry of Agriculture and Co-operatives, Moshi.
2000-10-05 Mr J.M.K. Kullayar, General Manager, Kilimanjaro Co-operative Bank, Moshi.
2000-10-06 Anonymous, Private Buyer, Moshi.
2000-10-09 Mr Kipuyo, Employee, Cooperative Rural Development Bank, Moshi.
2000-10-23 Mr Makusi, Employee at Statistical Department, Ministry of Agriculture and Co-operatives, Dar es Salaam.
Eight farmers in Kilimanjaro region have also been interviewed.

Statistics

Crop Monitoring and Early Warning Unit, Ministry of Agriculture and Co-operatives
Economic Research Bureau, University of Dar es Salaam.
International Financial Statistics, Database and Browser. International Monetary Fund
International Historical Statistics
Ministry of Agriculture and Co-operatives
Ministry of Communications and Transport
Sisal Estates
Tanzania Cashew Nuts Board
Tanzania Coffee Board
Tanzania Cotton Board
Tanzania Fertiliser Company Ltd
Tanzania Tea Board
Tanzania Tobacco Board

Websites

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www.africaonline.com
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www.worldbank.com