10 Summary and Conclusions

In this thesis, it is argued that in Burkina Faso, as in many other developing countries, well functioning food markets are a prerequisite for attaining food security. During the last decade, the cereal markets changed considerably in most West African countries. The markets have been liberalised and the role of the government in cereal trade has been restricted. However, cereal trade is still restrained by a large number of problems. As discussed in Section 1.2, this thesis aims at reaching two objectives. The first is to contribute to the discussion on the effects of market liberalisation and institutional changes on cereal flows and cereal prices in developing countries. For this purpose, I provide arguments with respect to the quantitative effects of actual and potential market changes on cereal trade and cereal prices in Burkina Faso. The second objective is to develop a mathematical model to analyse quantitatively the effects of changing marketing costs and market institutions on cereal trade flows and cereal prices in Burkina Faso. I examined three research questions in order to reach these objectives.

1. How may institutional improvements reduce marketing costs and influence the organisation of transactions on the cereal market in Burkina Faso?
2. Which mathematical formulation is appropriate and which assumptions and elements are essential, in order to analyse the effects of changing marketing costs and market institutions on cereal trade flows in Burkina Faso with the use of a mathematical model?
3. What is the quantitative effect of improvements in market institutions on cereal trade flows and cereal prices in Burkina Faso?

These questions are dealt with, respectively, Part I, II, and III of this thesis. Below, I summarise how I answered these questions, which conclusions can be drawn, and which lessons can be learned.

10.1 Part I: Cereal Trade and Marketing Costs

In Part I, I analyse how market institutions influence marketing costs and the organisation of market transactions on the cereal market in Burkina Faso. The Marketing Channel Approach and the theory of Institutional Economics provide the elements that are used for this analysis. According to the Marketing Channel Approach, the exchange of cereals from producers to consumers can take many
different forms (i.e. different marketing channels exist), depending among other things on the number of intermediaries involved. The intermediaries on the cereal market in Burkina Faso are assemblers, wholesalers, brokers, and retailers. They may purchase, collect, transport, store, and sell cereals. Furthermore, they negotiate on agreements concerning quality, delivery, price, distribution of risk, financial matters, and enforcement. The costs they make for these tasks can be classified in transport costs, storage costs, and transaction costs. The last cost type includes the expenses for the negotiation tasks and for gathering the necessary information. From a number of surveys performed in the past in Burkina Faso, it is derived that they are 5% to 14% of the price paid by the consumers. Moreover, transport costs are 5% to 20% and storage costs 6% to 9% of the consumer price.

According to Institutional Economic theory, the negotiations between the market agents result in agreements on the organisation of a transaction. For example, a onetime transaction on the spot market between a retailer and a consumer, a long-term relationship between a farmer and an assembler, or an assembler who is employed by a wholesaler. All organisational forms encompass different transaction costs. Which form is chosen depends on the motives of the market agents to start a trade relationship and on the nature of the transactions.

The nature of a transaction can be described by means of three attributes: the frequency with which transactions recur, the specificity of the assets necessary to come to a transaction (e.g. the skills, knowledge, and relationships of an assembler), and the degree and types of uncertainty in the transaction. The nature of a transaction is influenced by the state of the market institutions. These institutions are important, because they have to facilitate trade. Many problems on the cereal market in Burkina Faso are related to outdated market information, underdeveloped communication and road infrastructure, inaccessible courts, non-transparent market rules and regulations, a low degree of organisation, inaccessible capital markets, and low education levels. Due to malfunctioning market institutions, especially the attributes uncertainty and asset specificity may lead to high transaction costs. For example, because information on trade opportunities is difficult to obtain, it is important for a wholesaler to set up an expensive network of assemblers who know local market conditions; due to expensive or absent transport services and
communication infrastructure, wholesalers often send non-qualified but trustworthy relatives to remote areas, instead of qualified strangers whose behaviour can hardly be monitored; due to the inaccessibility of courts, agreements are difficult to enforce; non-transparent market rules and missing quality and quantity standards complicate entry of new traders in a region. Many of the uncertainties and of the associated costs are related to a lack of information on trade opportunities in the future and in other regions. Especially price uncertainty is reported to be an important impediment on the cereal market in Burkina Faso.

Various motives can be identified to start a trade relationship. An important motive is to reduce transaction costs. Others are to improve market access, to reduce supply uncertainty, or to reduce transport and storage costs. To improve market access or reduce transport costs, wholesalers invest in long-term relationships with traders on distant market places. To reduce supply uncertainty, traders close agreements with important farmers. To reduce uncertainty on the behaviour of employees (and hence reduce transaction costs), relationships between wholesalers and their employees are often based on family or clan ties. In these relationships, trust can more easily be maintained, information can more easily be obtained, and agreements can more easily be enforced. If market institutions evolve, it can be expected that market agents will rely less on clan-based relationships. Changing such relationships based on trust into impersonal exchange relationships based on contract, however, may take a long time. Powerful social groups may detain institutional changes if they do not suit their interest.

Using the elements discussed above, it is possible to answer the first research question. In Section 3.3, I formulate a number of scenarios of actual and potential institutional changes, and describe how they may affect marketing costs (i.e. transport, storage, and transaction costs) and the organisation of market transactions. These scenarios deal with improved information services, improvements in infrastructure, changes in cereal production, rising income levels due to economic developments, measures to improve market efficiency, more accessible credit facilities, and the national security stock maintained by the governmental organisation SONAGESS. In Section 10.3, I summarise the effects of these scenarios on marketing costs, cereal prices, cereal trade flows, and on the situation of the different market agents.
The question how transactions are organised and how institutions influence this organisation is not often raised in economic sciences. This question can be answered by combining the Marketing Channel Approach with the theory of Institutional Economics. It is easy to assert that institutions matter. However, it is more complex to explain how they affect the cereal market. By combining both methods it can be identified how institutions influence marketing costs and the organisation of transactions. Using the Marketing Channel Approach, the elements that make up the marketing costs can be disentangled, and it can be indicated how they differ per marketing channel. Using the theory of Institutional Economics, the way how institutional developments and the nature of the transactions affect the organisation of transactions can be investigated. By way of this analysis, it is possible to describe more accurately which institutional deficiencies cause problems on the cereal market in Burkina Faso and how they affect marketing costs. This gives the arguments to choose some vital scenarios of possible changes in market institutions, of which the effect on cereal trade will be analysed in Part III. It also provides arguments to adjust in Part II elements of existing partial equilibrium models to the specific circumstances of cereal trade in Burkina Faso. Furthermore, this qualitative and detailed description of cereal trade serves as a foundation for the parameter estimates, and it gives a justification for the conclusions as drawn from the model results. So, the above analysis lays the foundations for the rest of the research.

10.2 Part II: Modelling Cereal Trade

In Part II, a mathematical model is developed to analyse quantitatively the impact of the scenarios formulated in Part I on cereal trade flows and cereal prices. Central in this model is the interaction between the various actors on the market: producers, consumers, and traders. Especially the supply behaviour of the cereal producers, and the transport and storage decisions of cereal traders under future price uncertainties receive ample attention. In this section I briefly review the main principles and assumptions of this model. I do not discuss in detail the structure of the model and the theoretical properties of the model results, although they are the heart of this thesis.
Summary and Conclusions

The model is based on the spatial price equilibrium model developed by Samuelson (1952) and Takayama and Judge (1971). In their model, a semi-welfare function is maximised, subject to an equilibrium constraint which imposes that producer supply is equal to consumer demand. In this thesis, two extensions have been made to the model of Takayama and Judge. First, trader behaviour has been taken into account explicitly. Takayama and Judge argue that their model, in which only producer and consumer behaviour are considered, describes accurately market price formation. In my opinion, when analysing cereal trade, the process of price formation can be made more transparent if the behaviour of cereal traders is explicitly taken into account as well. The traders purchase cereals from the producers and sell them to the consumers. The market clears, i.e. is in equilibrium, because the traders do not purchase from the producers more than they can sell to the consumers during one of the periods in one of the regions of the country. Furthermore, it follows from the profit maximising behaviour of the traders, that, on a perfectly competitive market, the difference between the price a consumer pays and the price a producer receives is equal to the costs made on the market. A second extension is the incorporation of uncertainty on price development. Future price uncertainty is said to be one of the main problems on the cereal market in Burkina Faso. I would like to analyse whether this is true indeed. Including future price uncertainty into spatial equilibrium models is not an easy task. Future price uncertainty affects the way the behaviour of the individual producers and traders can be modelled. As a consequence, it affects the equilibrium model, which is based on specifications of the behaviour of the individual market agents. Future price uncertainty can properly be included, if the role of traders is taken into account.

Step by step, I set up a stochastic, multi-period, spatial equilibrium model, reflecting the supply and demand behaviour of the market actors and the price formation process on the cereal market in Burkina Faso. This model is based on a description of the optimal behaviour of the market actors: producers, consumers, and traders. Only one type of traders is considered, which performs all tasks of the assemblers, wholesalers, brokers, and retailers, discussed in the previous section. It is assumed that cereal producers maximise their profits from cereal sales, consumers maximise their utility from consumption, and cereal traders maximise their profits from purchasing cereals from the producers and
selling to the consumers. Producers, consumers, and traders are all price takers. I divide a year from one harvest to the next in four periods of three months each (October-December, January-March, April-June, July-September), and Burkina Faso in twelve regions (the twelve agricultural extension regions, CRPAs, see Figure 1.1).

For the consumers, it is assumed that their demand behaviour can be described by a cereal demand function. This function gives the utility maximising demand level as a function of cereal prices. Furthermore, it is assumed that consumers do not store cereals but purchase in each period only their demand levels for that period. To describe producer behaviour, an approach is followed which differs from the standard micro-economic approach of deriving supply functions. Based on a careful review of the supply behaviour of cereal producers in Burkina Faso, it is assumed that, in one year, they consume a part of their cereal harvest themselves, and that they can sell the remainder. Furthermore, in each period they have to sell a minimum amount of cereals (‘forced sales’). Future prices are a stochastic factor for the producers. In each period, they decide on the quantity sold, in such a way that their expected net revenues for the rest of the year are maximal. Finally, cereal traders decide in each period about the amount of cereals they purchase, sell, transport to other regions, and store. Also for them, future prices are a stochastic factor. They choose the strategies for which their expected net revenues are maximal.

The models simulating the optimal behaviour for each of the actors are combined into a model which maximises a semi-welfare function subject to the constraint that the quantities purchased by the traders, are also sold in any of the regions and in any of the remaining periods (equilibrium). The semi-welfare function in fact reflects the sum of the producer, consumer, and trader ‘expected net revenues’. Herein, consumer net revenues are defined as the utility obtained from the cereals purchased minus the costs from purchasing them. The resulting stochastic, multi-period, spatial equilibrium model determines simultaneously the quantities transacted for all individual market actors and the prices for which the market is in equilibrium. It is proved that the results of the equilibrium model are equal to the sum of the optimal quantities transacted by the individual market agents at the equilibrium prices. Furthermore, it is proved that on a competitive market, for each transaction in a certain period, the difference between the optimal consumer and producer prices is equal to the
costs made by the traders. The results show that the interaction between the individual producers, consumers, and traders, who all pursue their own goals, leads to market prices and to transacted quantities which are optimal for all, and which, under constant conditions, can not be improved upon for one of them without harming others.

10.3 Part III: Effects of Liberalisation Policies on Cereal Trade

In Part III, the third research question is considered. The parameters of the model as set up in Part II are estimated on the basis of a detailed review of a large number of surveys which have been executed in the past in Burkina Faso. Furthermore, the impact of the scenarios formulated in Part I on cereal trade and cereal prices is examined using the model set up in Part II.

First, the base model, i.e. the model with the parameter values as estimated in Chapter 7, is considered. The results of the base model reflect actual prices and trade flows on the cereal market in Burkina Faso fairly well. They show that optimal equilibrium prices are highest in the shortage areas Centre, Sahel, Nord, and Centre Nord, and lowest in the surplus areas Mouhoun, Hauts Bassins, and Sud Ouest. The optimal equilibrium prices reflect the costs which are made by the traders. These costs are relatively high in Burkina Faso, because of malfunctioning market institutions. As a result, traders have to rely on expensive networks of assemblers, carriers, retailers, and brokers they can trust to collect, transport, and store cereals, search for market information, monitor agents, and maintain relationships with clients.

In the optimal solution, traders transport the surpluses from the surplus regions to the shortage regions. The transported quantities are high especially during the lean season, from July to September. Traders only store a small part of the total quantity transacted. The results show that most producers do net sell their largest quantity early in the year. This is in contrast with the widespread view that many producers in Sub-Saharan African sell early in the year, when prices are low, instead of in one of the later periods, when prices are higher. Note that the results only show aggregate supplies. If more classes of producers were distinguished in the analysis, it is well possible that the results would show that poor farmers have a different supply pattern.
The first scenario deals with the influence of road and communication infrastructure on cereal trade. If the quality of infrastructure improves, transport costs will decline which may stimulate more traders to transport to remote areas. The model results show that transport is stimulated indeed, but that the direct effect on the quantity transported is small if transport costs between the main cities in the different regions decrease. It is considerably less than the effect attributed to transport costs by a number of Worldbank studies (Worldbank, 1994, 2000b, see Section 8.2). The effect of transport costs on equilibrium prices is weak, because the transport costs for the main routes only make up a small part of prices. Due to the forces of supply and demand, prices in the importing regions fall, but the prices in the exporting regions rise. The price decrease in the importing regions can only be modest because of the inelasticity of supply. If the fall of consumer prices would be larger, demand would increase. This can, however, not be satisfied because supply hardly reacts on small price changes. As a result, prices in the importing regions decrease with a small percentage, prices in the exporting regions increase with a larger percentage, and transport flows increase a little bit.

The effect will be more pronounced if improvements in infrastructure also affect transaction costs. Due to better infrastructure (especially rural roads, telephone and fax lines), assemblers can more cheaply purchase and sell in remote regions and wholesalers can hire non-relatives with less risk of breach as they can monitor their agents more easily. The model results show that producers, consumers, and traders will benefit from these changes. Traders can offer higher prices to the producers, demand lower prices from the consumers, and transact larger quantities. The result that infrastructure has a considerable influence on the situation of the rural population is supported by Fan et al. (2000). They conclude for the case of India, that poverty is reduced substantially if the government invests more in rural roads.

If specific routes are asphalted, transport to and from remote regions may show unexpected changes. Optimal equilibrium prices in the shortage regions along the newly asphalted roads will decline, and quantities transported over these roads will rise, although the effects are small. However, traders will transport less to the other shortage regions, where prices will rise. This has negative consequences for the consumers and retailers in these regions. Furthermore, transporting from the regions which are not along the new road
becomes relatively more expensive. As a result, the optimal solution shows that the surplus regions in the rest of the country may lose their competitive position. Wholesalers will be more inclined to purchase in the regions from which transport is cheaper. Especially producers and assemblers in the remote surplus regions may notice this effect. This aspect may even be stronger if also spin off effects of improvements of infrastructure are considered. If economic activity increases in the regions connected by the new road, demand in these regions may increase at the expense of the consumers in other regions.

The second scenario deals with the effect of changes in cereal production on prices. An important objective of the government of Burkina Faso is to increase cereal production levels. This would be positive for the income and cereal consumption levels of the rural population and for their negotiation position because they are able to supply larger quantities. For the traders, also transaction costs per kilogram may decrease because they can purchase larger quantities at once. If production increases, the results show that the producer and consumer prices will fall because of the diminishing scarcity of cereals. As a result, consumption levels increase, which is positive for the consumers. An unwanted effect is that, despite the higher supply levels, a rise of production may result in a deterioration of the net producer revenues, if the production costs of the farmers do not fall. If also production costs fall, net revenues may rise.

If production improvements are concentrated in only some regions, then the results show that, in most of these regions, the negotiation position of the farmers improves. Despite the larger supplies in these regions, prices decrease by more or less the same percentage as in the other regions. This is caused by the forces of supply and demand, due to which price differences between regions can not become higher than transport costs. However, it is possible that, due to the price decrease, cereal supplies of the producers in some of the remote regions increase with a smaller percentage than production. It is possible that, instead of purchasing from the local producers in these remote regions, traders prefer to import cheaply from other regions where prices are lower. Likewise, it is possible that transports from these regions can not compete with transports from other, cheaper regions.
The model results demonstrate that higher supplies in one region lead to higher consumption levels in the entire country. If production increases in surplus regions, then traders will transport a part of the extra supplies to the shortage regions. If supply increases in the shortage regions, then traders will transports less to these regions. Furthermore, if a rise in production does not go hand in hand with an adaptation of price expectations, it is possible that producers do not spread their supplies equally over the year. This may result in large surpluses and a fall in producer prices at the end of the season. This is an important reason to analyse in the fifth scenario the importance of price expectations. Not only in the case of production increases, but especially in the case of a bad harvest, information on the expected impact of production changes on prices is important. In that case, supplies may be too high early in the year, resulting in sky high prices and a large shortage at the end of the year.

In the third scenario, the effect of an increase of consumer income is highlighted. If consumer income would increase due to economic developments, then demand would increase. However, the results show that demand only rises by a small percentage. Because of the inelasticity of supply, producers can hardly supply more, resulting in a sharp price increase. Especially producers will benefit from this. Only if higher producer prices lead to more supply, higher income levels may result in more consumption. Note that consumption levels may also rise if more maize and rice is imported. Also in this case, the importance of correct information on price developments is clear. If producers and traders do not have information on changes in demand and their effects on prices, prices during the lean season, from July to September, may rise sharply. This may even result in a fall in consumption, in spite of the higher income levels.

Changes in consumer income of specific groups due to certain economic developments affect prices in all regions. If incomes rise in some regions or only for urban or for rural consumers, prices in all regions rise and demand in the areas in which incomes rise will increase. Demand in the other regions, however, declines. An improvement of income only for urban or for rural consumers may have negative consequences for others. Account has to be taken of these adverse effects if specific developments are promoted, especially if they touch the poorest.
The fourth scenario considers the effect of an efficiency gain in cereal trade. If traders receive better education and training, they may have better abilities to manage their businesses, deal with uncertainties, and monitor their employees. As a result, their transport, storage, and transaction costs may decrease considerably. Also if laws and regulations related to cereal trade are better implemented, traders may experience less problems with police officers and government officials, leading to lower costs. The model results show that these improvements lead to more transport and storage, which leads to higher consumption in the shortage regions. Less well trained traders may lose their competitive position to better trained newcomers. Also the position of the remote surplus regions may improve. Account has to be taken of powerful traders with high marketing costs who may abuse their power by preventing the entry of new traders which is not in their interest, and thus hindering market liberalisation.

Efficiency may also be improved if traders purchase larger quantities from farmer co-operatives. In that case, traders do not have to bear the costs and run the risk of a network of assemblers and agents. Furthermore, farmers will have a better negotiation position and may experience considerable efficiency gains. The model results show that both farmers and traders may profit. A fall of consumer prices may go hand in hand with an improvement of the producer net revenues and a more equal spread of supply over the year.

In the fifth scenario the role of information with respect to future price developments in cereal trade is examined. Having adequate future price expectations is important to make trade decisions. However, it is difficult for cereal traders and producers in Burkina Faso to make good price expectations because of the difficulty to obtain correct and up-to-date information on market developments. Having access to better price and market information and knowing how to interpret this information, may result in more adequate price expectations. In Part I, it has been argued that if information is more easily available, traders run less risk to make wrong decisions and can more easily monitor their agents. Furthermore, producers and small traders will have a better negotiation position. For this scenario the stochastic equilibrium model is
compared with a model in which producers and traders are in a hypothetical situation where they have perfect foresight with regard to future market prices.

The results of this analysis show that having better price expectations is important. If traders and producers have wrong expectations, it is well possible that too much is sold during the first periods leading to a shortage at the end of the year and prices rocketing up in the lean season. If better information is available, price developments over the year will be smoother. Due to the improvement of the negotiation position of the producers, they are able to supply their produce more equally over the year. Also traders may operate more efficiently. Transport to surplus regions that also export abates, and storage is done by the producers, who can store at lower costs than traders. These changes are detrimental for transport agencies who see their markets decrease or traders who have invested a lot of time and effort in setting up private trade and information networks. Organisations aiming at improving public market information systems have to be aware of the possibility that traders do not want to share their information or provide wrong information to thwart the plans.

In the sixth scenario the accessibility of credit is analysed. Credit is generally considered to be one of the main constraining factors of cereal trade. A lack of credit opportunities would prevent small traders from extending their businesses and prevent employees of wholesalers to start their own cereal trade business. If credit is more easily accessible, the need for setting up extensive trade networks with pre-financed agents will be less an issue. Trade between individual traders will augment, and competition will increase. In this case, the model has been extended with a constraint on the borrowed capital.

The results of the analyses clearly show that the level of competition rises if the availability of capital improves, indeed. If not enough capital is available to finance new entrants on the market, traders can make excessive profits. They may offer low producer prices and demand high consumer prices. Furthermore, transport or storage is not necessarily done by the most efficient trader. If credit is more easily accessible more cereals will be supplied, consumed, transacted, and transported, and prices will be fairer. Especially the remote regions will profit from the improved level of competition.
Finally, the seventh scenario analyses the question whether the annual renewal of a part of the national security stock by SONAGESS disrupts the market. This seems not to be the case. According to the model results, the purchases of SONAGESS in the surplus regions and the supplies in the shortage regions only have a small effect on prices. The main effect is that the traders transport less cereals to the shortage regions. Demand levels in the shortage regions are not affected by the presence of SONAGESS. I have to note that it is not possible to say on the basis of the model results whether competition will be disturbed. This depends on whether they only sell to a few large wholesalers or also in smaller quantities to smaller traders.

10.4 Policy Recommendations and Final Remarks

To conclude this thesis, I want to raise two issues. First, I want to formulate some policy recommendations that follow from the analysis in this thesis. Secondly, I want to make some remarks on the main contributions of this thesis to the discussion on the effects of institutional changes on cereal trade and cereal prices.

On the basis of the analysis in this thesis, it is possible to formulate some recommendations on improvements of market institutions that might be initiated by policy makers or development institutes. First, implementing only a single improvement will not have the desired effects. It is better to tackle the problems simultaneously. For example, if credit is easily accessible but information is still difficult to obtain, new traders will still have difficulties extending their trade networks. Secondly, it is important to support activities aiming at improving cereal production levels. One may think of strengthening agricultural research and extension services, reinforcing agricultural input markets, and supporting all kinds of local initiatives to improve soil fertility, yield levels, or labour productivity. Evidently, food security improves if more cereals are produced. Improvements of cereal production not necessarily have to take place in the shortage regions. If the purchasing power of the population in the shortage regions is sufficiently high, surpluses will be transferred to the shortage regions anyway. Promoting food security by improving income levels will not have the desired effects unless also cereal production increases. Otherwise, prices will increase, which may even result in less consumption for a part of the
Thirdly, credit facilities must be reinforced and more initiatives must be taken to provide trade credits to small traders. A lot of knowledge is available on setting up micro-credit programmes for similar situations. More credit loans will improve competition, stimulate traders to extend the activities for which they have a comparative advantage, and encourage traders to start their own trade business. Fourthly, improvements of information facilities are essential. For traders and producers, it is important that reliable data on cereal prices and (expected future) price developments are transmitted on time by the Système d’Information sur les Marchés (SIM), that estimated cereal production levels per region are published by the Ministry of Agriculture before the new harvest, and that important economic developments that may affect cereal supply or demand are published. Only if traders have accurate and timely information on market developments and if they know how these developments may affect prices, sudden price shocks may be prevented. Fithly, investments in training facilities where traders can learn all kinds of trade skills, like organising, negotiating, managing, and interpreting market information, will improve trade efficiency and competition. If traders operate more efficiently, more may be transacted and especially competitiveness of traders and producers in remote regions may improve. Sixthly, the set up of farmer co-operatives must be encouraged. Important efficiency gains may be achieved if more farmer co-operatives are set up which supply the production of the member farmers. The negotiation position of the farmers will improve, and marketing costs will fall for producers and traders who can transact larger quantities at once. Finally, before improving road infrastructure in a certain region, the reason has to be asked why choosing this particular road, and what is expected to be the effect for the people along the road and for those in the rest of the country. Such improvements probably only result in a small increase of the quantity of cereals transported, and it may have unintended effects in other regions. Simultaneous improvements of road and communication infrastructure (especially rural roads, telephone and fax) will have a much larger effect on the quantities transacted. Such improvements may lead to a considerable gain of efficiency for the traders. All these effects have been quantified in this study by means of a stochastic, spatial equilibrium model.
To conclude, I want to note that the results of the analyses executed in this thesis and the conclusions which have been drawn, clearly reveal the effects of some important institutional deficiencies on the cereal market in Burkina Faso. For example, taking into account the uncertainty of future prices has shown how wrong information may result in large shortages and unnecessary price fluctuations; analysing the role of credit has shown that competition is at stake if capital is constraining; inefficiencies by traders may not only result in a loss of capital, but also affect the competitive position of producers in remote regions. Furthermore, an important result of the model is that some claims on the effects of market changes, which have become widely accepted, need some critical reflection. For example, improving infrastructure in one region may unintentionally aggravate the situation of the poor in other parts of the country; economic developments in one region, may lead to higher demand for some, but also to a decline of purchasing power for others, because of a price increase in the entire country; a production increase in only a part of the country will lead to declining prices in the entire country, in this way lowering the income of farmers in other regions. If new initiatives are displayed to improve food security, account has to be taken of these unintended effects. If possible, it has to be attempted to compensate to some extent those who are affected negatively by market improvements.

One of the contributions of this thesis is that it also shows the nuances of how institutional changes may affect cereal prices and cereal distribution and how they may affect the relationships between the market agents. For individual producers or traders, not the overall effects of institutional changes are important, but the way how they are affected individually. Market agents who are affected negatively by institutional developments may frustrate or even block these developments (see also Section 3.2). The evolution of market developments may be governed more efficiently if potential problems are known and tackled beforehand.

Without the use of the equilibrium models and the extensions I made, controversial as they may be, I would not have been able to obtain such nuanced results. Although including the uncertain character of future prices resulted in a considerable complication of the analysis, it was important. Without this extension, I would not have been able to show how uncertainties on future price developments affect the present and future market situation, and to show the
significance of having access to correct information. If a part of the market actors has incorrect expectations on future price developments, all market actors will be affected. In that case, prices may be different from prices in a situation in which expectations are better, supply and demand may decline, and cereals may even be disturbingly scarce during the lean season. Without the models and especially the insights they provide about the interaction between the market agents, it would be difficult to explain convincingly some of the results. Adverse effects of seemingly positive market changes, like improvements in road infrastructure, cereal production, and income levels, are easily overlooked, if cereal trade is analysed in a more general way. The influence of specific costs or behavioural constraints on market prices and quantities traded, can not be entirely understood if they are not studied in an integrated analysis of the behaviour of all producers, consumers, and traders on the cereal market. On the basis of a qualitative study alone, the functioning of the cereal market can not be fully explained. By interviewing market agents, one does not learn exactly how the market works. They may know their own strategies and problems, but they do not know exactly how interactions between agents or certain developments on the market affect prices and transactions in other regions of the country. Only by using an instrument with which the interaction between the market agents can be represented, the complex nature of cereal trade can be explored in an integrated way.