S. van Berkum
H. van Meijl

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USABILITY OF TRADE THEORIES IN EXPLAINING AGRICULTURAL TRADE
Part two of the project 'Policy and patterns of international trade'

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ABSTRACT

This report identifies the application of various trade theories in explaining trade
in agricultural and food products. First, some general observations on the characteris-
tics of agricultural products and trade are presented. Next, an analytical framework to
analyse trade in agricultural and food products is developed by matching characteris-
tics of agricultural products and trade patterns with trade theories. This framework or
concept depicts which theories are expected to be most appropriate in explaining tra-
de in certain more or less homogeneous groups of agricultural and food products. Fur-
thermore, trade theories actually used in empirical studies to explain trade in agricultu-
ral products are reviewed. Finally, potentially fruitful research areas in agricultural
trade analysis are identified which are those areas where certain characteristics of agri-
cultural products may be expected to be important determinants of trade patterns but
to which research has paid too little or no attention.
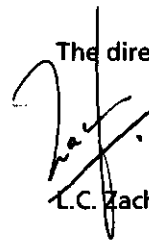
Agriculture/Trade/Theory

CONTENTS

FOREWORD

Most agricultural trade analysis focuses on basic agricultural commodities and rests on traditional theoretical insights of comparative advantage, assuming perfect competitive markets on which goods are homogeneous and produced under a technology of constant returns to scale. However, the observation of changing trade characteristics in agriculture and food products, private business concentration and active government policy suggest that international agricultural trade analysis implies investigating market structures other than the competitive mode. In order to strengthen and buildup the theoretical and empirical knowledge base in the field of international trade in agricultural and food products, the Agricultural Economics Research Institute (LEI-DLO) launched the research project 'Policy and Patterns of International Trade' which is financed by the Institute's budget for Strategic Expertise Development (SEO programme).

The objectives of this research project are to:
- analyse international trade theories, with the aim to answer the question: what determines international trade patterns and which role does government policy play in this?
- assess the usability of general trade theories in explaining agricultural trade;
- design a concept for explaining world trade patterns in agricultural commodities.

This publication reports on the second stage of the project (the first stage of the project has been published as Onderzoekverslag 161, 'A survey of trade theories'). The aim of this report is to identify the usability of the various trade theories in explaining trade in agricultural and food products. Furthermore, the study identifies potentially fruitful research areas in agricultural trade analysis.

The director,

The Hague, April 1998

L.C. Zachariasse

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1. INTRODUCTION

The aim of the second part of the research project 'Policy and patterns of international trade' is to identify the usability of the various trade theories in explaining trade in agricultural and food products. In the first part of this study we concluded that there was no general theory that explained trade in all situations, but there were many theories which were each appropriate in particular situations. In this conclusion, we follow Leamer (1993: 439) who states that 'to make progress, economists ought to abandon the idea that models are either true or false in favour of the notion that models are sometimes useful and sometimes misleading'. Models are only tools, nothing more and nothing less. Leamer stresses that each of the theoretical trade models is appropriate in some circumstances and inappropriate in others, and therefore, empirical studies should not try to test the validity of the theories. Instead, he claims, empirical work 'might identify the circumstances under which each of the tools is most appropriate, or measure the 'amount' of trade that is due to each of the sources.'(Leamer 1994: 69).

Therefore, to get an idea of the usability of trade theories we first present some general observations on the characteristics of agricultural products and trade. We describe characteristics of trade patterns such as the importance of intra-industry trade 1), the importance of trade in processed goods versus trade in basic products and the importance of government policies for agricultural trade. We look at the importance of these characteristics across nations and across time. A match between the characteristics of trade patterns and whether or not a certain trade theory can explain these characteristics provides some initial information whether a certain theory is potentially suitable for explaining trade in certain agri-products.

Next, we develop an analytical framework to analyse trade in agricultural and food products. This framework is based on the confrontation of the characteristics of agricultural products and trade patterns with trade theories. This framework or concept describes which theories are expected to be most appropriate in explaining trade in certain more or less homogeneous groups of agricultural and food products. We will construct this framework in three steps. First, we identify the factors that may be important determinants of trade patterns according to the various trade theories. Second, we evaluate the importance of these factors for (general groups of) agricultural products. And third, we identify the trade theories that are potentially well suited to explain trade patterns in the groups of agricultural products identified.

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1) Intra-industry trade: the simultaneous export and import of products that are very close substitutes for each other in terms of factor inputs and consumption (Tharakan, 1985).

Furthermore, we study which trade theories are actually used in empirical studies to explain trade in agricultural products. We present therefore a survey of the literature reviewing the application of trade theories to agricultural trade. Finally, a confrontation or match between theories actually used and theories that we expected to be used gives an indication whether the expected theories are used and where potentially fruitful research areas are. The potentially fruitful research areas are those where we expect certain characteristics of agricultural products to be important determinants of trade patterns and where research has paid little or no attention to.

In section 2.1 we describe the characteristics of trade in agricultural products and discuss the implications for using trade theories which may be potentially able to explain such trade patterns. Further in section 2, we develop a concept that describes which theories are expected to be useful for analysing trade in agricultural and food products. The following section is a review of the empirical literature on the field of agricultural and food products. Section 3.2 concentrates on the application of traditional trade theories while section 3.3 reviews literature in which elements of modern trade theories are used to analyse and explain international trade in agricultural and food commodities. The relevance of 'new' growth theories for agricultural trade analysis is the subject of section 3.4. In section 4 we identify the potentially fruitful research areas by a comparison of the expected theories (section 2.2) and the theories actually used (section 3). A brief summary and some conclusions are in the final section 5.

2. A MATCH BETWEEN CHARACTERISTICS OF TRADE IN AGRICULTURAL PRODUCTS AND TRADE THEORIES

2.1 Characteristics of trade in agricultural and food products

In order to evaluate the usability of trade theories in explaining agricultural trade flows and patterns, we start by presenting five general interrelated observations on the characteristics of agricultural trade:

1. *The largest part of agricultural and food trade is between developed countries*
    The OECD members - developed, industrialized countries - take a dominant share in world agricultural trade flows. OECD countries are involved in around two-thirds of all agricultural trade (imports and exports) in the world and most trade is between developed countries. Special reference should be made to the EU. The EU intra-trade (between EU countries) accounts for about half of total value of world trade in agricultural products, indicating the EU's giant position in international agricultural trade. Apart from the significance of EU's internal trade flows in the general picture of international trade in agricultural commodities, the position of the USA should be stressed as the major exporter of agricultural products in the world.
2. *The importance of trade in processed (high value) agricultural products increases at the expense of trade in basic products*
    There is a trend that the importance of trade in processed agricultural products increases at the expense of trade in basic products. McCorriston and Sheldon (1991) report on these developments since 1960. Since the mid-1970s the value of world trade in processed products has been growing at a faster rate than bulk commodities. This trend has continued in the 1980s. In 1988 - the last year both authors report on - processed products account for 60% of world agricultural trade with bulk and intermediate products accounting for equal shares of the remainder. Traill (1996) records an annual growth rate of 9.4% per year for trade in processed products between 1961 and 1990 compared with 2.1% growth for agricultural bulk commodities over the same period. Traill notes a striking difference between the EU and US in this respect: the processed 'high-value' products account for 85% of EU food and agricultural exports but only 60% of American.
3. *Trade in processed food products is concentrated in a few countries: France and the Netherlands take a leading position*
    Traill (1996) refers to a study by Dayton and Henderson (1992) in noting that trade in manufactured food products is concentrated in the hands of a relatively small number of countries: 30 developed and newly indus-

trialized countries (NICs) account for 90% of processed food imports, of which the NICs' share was only 6%. McCorriston and Sheldon (1996) confirm the dominance of the EU in the world trade in food and agricultural products as exporter of processed food products. Referring to 1990 data from ERS/USDA the authors report that the EU countries are among the leading exporters of processed food products with France and the Netherlands together accounting for around 20% of total world trade in manufactured foods.

4.   *Trade in processed products between developed countries is of an intra-industry trade (IIT) nature*
      Traill (1996) finds that most trade in processed products between developed countries is of an intra-industry trade (IIT) nature (see section 3.3). Gomes da Silva (in Traill, 1996) estimate an increasing level of intra-industry trade in food, drink and tobacco industries in the EU-12 countries in the period 1980-1992. In all countries but one (Denmark) the indices that measured intra-industry trade increased, most notably in the Mediterranean countries Spain, Greece and Portugal where IIT was previously least important.

5.   *Government policy is an important determinant of trade in agricultural products*
      The impact of government policies on trade patterns may be direct through the use of export subsidies and/or import barriers, but can be indirect through the consequences of the use of domestic price and income support. In the field of agriculture the use of domestic policy instruments supplemented by restrictions on imports through quantitative or price measures were and still are so widespread and significant that governmental policies are indeed a pervasive noncompetitive element in international trade in agricultural products. The goals of income redistribution, internal market stability, food security, and controlled structural adjustment have been amongst the most important reasons for and the nature of intervention. International trade patterns therefore can not be explained in terms of the efficiency focus of pure trade economics but instead one has to take into account the policy interventions at hand.

Implications for usability of trade theories
      The observations indicate that agricultural trade is concentrated mainly between the developed countries of the world and the products traded are increasingly of a processed nature. These observations of the characteristics of international trade have important implications for the usability of trade theories in analysing international trade in agricultural and food products. The first characteristic indicates that trade is the most important between countries with

more or less similar factor endowments 1). This would imply that the standard Heckscher-Ohlin-Samuelson (H-O-S) approach is not always suitable to explain all agricultural trade. The second characteristic indicates that trade in differentiated, processed products becomes more important, which implies that the relevance of modern trade and growth theories increases relative to traditional theories. The third characteristic has similar implications as the first one in the sense that trade in processed products is mainly between countries with more or less equal factor endowments 2). The fourth characteristic implies also that the traditional theories are not well suited for trade in processed food products because these theories cannot explain intra-industry trade. The last characteristic implies that government policy should be taken into account as a determinant of agricultural and food trade patterns. Modern trade theories add some arguments for government policy in comparison to the traditional ones, which makes it useful to consider the views on government interventions based on modern trade theories and include them in the analyses of agricultural trade flows.

We can, therefore, hypothesize that agricultural trade is becoming more and more of the type that needs to be explained by modern trade and growth theories and where determinants other than factor endowments and natural circumstances (*the* explaining determinants according to traditional theories) play a discriminating role.

2.2 A conceptual framework for trade in agricultural and food products

Following the empirical observations on the characteristics of agricultural trade and the possible implications for the usability of trade theories in explaining these trade patterns, a framework to analyse trade in agricultural and food products is proposed in this section. This framework is constructed in three steps. First, we identify the factors that may be important determinants of trade patterns according to the various trade theories. Second, we evaluate the importance of these factors for (general groups of) agricultural products. And third, we identify the trade theories that are potentially well suited to explain trade patterns in the groups of agricultural products identified.

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1) It should be recognized, however that there may be huge structural differences between OECD countries too, like the difference between the Netherlands, a densely populated country with relative scarce land, and the USA, a much less populous country with relative abundance of land.

2) Furthermore, it implies for further research at LEI-DLO that trade in processed foods is especially important for the Netherlands.

Features of products, markets and countries	Trade theories that stress this feature
- Natural Resources (climate, soil, geographical position)	Ricardo
Production factors	
- Factor endowments (land, labour, capital)	Heckscher-Ohlin-Samuelson
- Human capital/knowledge	Modern trade theories, growth theories
Sector/goods:	
- Differentiated goods	Modern trade theories, growth theories
Technology:	
- Internal Economies of Scale (firm level)	Internal economies of scale approach, growth theories
- External Economies of Scale (industry level)	External economies of scale approach
- Technology differs between countries	Ricardo, neo-technology, growth theories
- Process innovations	Neo-technology, growth theories
- Product innovations (quality enhancing/more product varieties)	Neo-technology, growth theories
- Knowledge spillovers	Neo-technology, growth theories
Consumer preferences	
- Income elasticity	
Market structure	
- Perfect competition	Traditional trade theories
- Imperfect competition	Modern trade and growth theories
Government	
- Policies (e.g. trade policy)	All trade theories
- Physical infrastructure	Ricardo
- Knowledge infrastructure	Neo-technology and evolutionary growth theory

Figure 2.1   Trade determinants and theories related to these factors

2.2.1   Factors of importance

Trade patterns are dependent on different factors that are related to the kind of products under consideration. The various factors are related to the main mechanisms of trade stressed by different trade theories (see Van Berkum and Van Meijl, 1998). The main features of products, markets and countries which can be important determinants of trade and the trade theories that stress these features are summarized in figure 2.1.

2.2.2   Identification of products

Determinants of international trade patterns of agricultural and food products are dependent on the type of product, the features of the market (structure) and countries at hand. Focusing on the products in trade, these have many, sometimes very specific characteristics. For analytical purposes, we try to identify common features of these products to group them. Following Breimyer (1962) and Abbott and Bredahl (in Bredahl et al., 1994) we define groups in terms of characteristics of economic activities. Important characteristics are the level of processing (at farm or industry level) and the linkage of production to end-use characteristics. The taxonomy of product groups is also dependent on the relative importance of product versus process technology and the resulting value added in the economic activity. The three broad groups of agricultural and food products we find useful to define as a basis for identifying factors affecting patterns of trade are:

- *undifferentiated primary products*
  homogeneous products that are produced in the primary agricultural sector (at farm level). There is no two-way linkage between production and end-use characteristics in final consumption;
- *differentiated primary products*
  differentiated products that are produced in the primary agricultural sector (at farm level). There is a linkage (interaction, i.e. a two-way ex- change of products and information) between production and end-use characteristics in final consumption;
- *processed food products*
  primary products that are conversed into processed food products. The production of these products is dependent on end-use characteristics in consumption. Further to these end-use characteristics this product cate- gory could be split into semi-processed products (conversion of primary products and commodities into products for further industrial processing) and consumer-ready products (conversion of primary and semi-processed products into products for final consumption).

The relations between these groups are given in figure 2.2. Below the key characteristics of the products grouped together are described more explicitly.

Key characteristics of the groups of products identified
   Undifferentiated primary products are - in principal - homogeneous prod- ucts of a raw material nature, of which product features other than the price do not matter (or are not discriminating between products and its substitutes). Examples of such products could be wheat (unmilled), oilseeds, fresh fish, milk (butter) or eggs. Moreover, these products have a bulky character, which means that the product technology is rather simple and the resulting value added of the activity is relatively low. The farmers/traders producing/handling these products are not in a position to influence the prices on the markets.
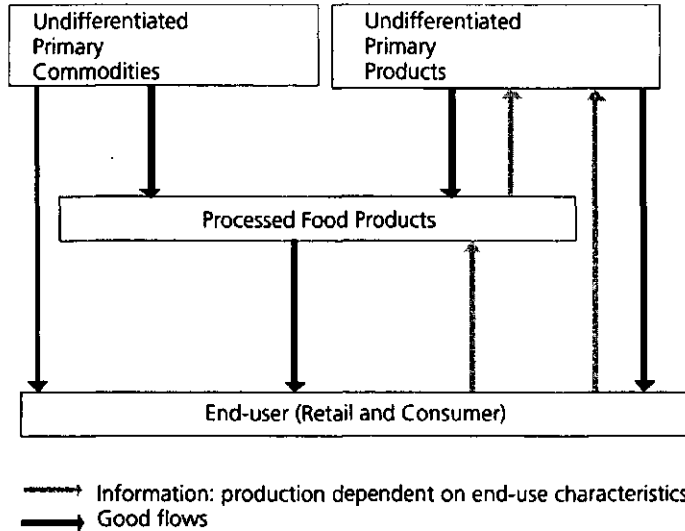
Undifferentiated Primary Commodities		Undifferentiated Primary Products

Processed Food Products

End-user (Retail and Consumer)

➡ Information: production dependent on end-use characteristics
➡ Good flows

Figure 2.2   Relations between the three groups of agricultural products

Therefore, the market structure from the suppliers' view can be characterized as perfect competition. However, if a (processing and/or trading) firm or country is dominating international trade (i.e. has an dominating market share), it may use its position to affect market conditions even for a undifferentiated product. So, imperfect competition may be of relevance if a market analysis shows huge firms or countries are prevalent in trade of undifferentiated primary products.

Because products are homogeneous and, in general, prices cannot be influenced by suppliers, the only way to compete and make profits is by producing and distributing at low costs. Costs of production are dependent on natural resources (climate, soil), production factor prices (dependent on factor endowments) and the productivity of the production factors. Production innovations are important to increase the productivity of the production factors, however, this gives a country only a temporary advantage because knowledge spillovers are important (technology is mobile). Costs of distribution are dependent on natural resources such as distance to important consumer markets and the physical infrastructure provided by the government. Furthermore, agricultural and trade policies are important for these products because they may influence production costs and prices directly.

The second group of products we distinguish is that of *processed food products*. The processing of agricultural raw materials results into many differentiated food products, either for further industrial processing or for household consumption. In most developed countries agricultural processing is an industry in which highly skilled labour, capital and knowledge intensive production methods are applied. Moreover, it is an industry continuously innovating new products. In these kind of industries, product differentiation could the

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main strategy and production costs are less decisive (but still not unimportant!) with regard to trade patterns than in the case of undifferentiated primary products. Production costs themselves are less dependent on natural resources and the costs of production factors, but more on economies of scale and economies of scope caused by, for example, fixed R&D and marketing costs. Examples of these products are meat preparations, dairy products (cheese) and meal and flour from wheat.

Although the majority of food processing companies is still of a rather small scale type, there are also large food processing enterprises prevalent in these markets (see, for instance, OECD, 1983; Connor et al., 1985; Brehdahl et al., 1994). Sometimes, these companies have grown into big multinationals. This suggests that one may speak of an oligopolistic market structure rather than of perfect competition. Oustapassides et al. (1995) note that there is even a general trend towards increasing concentration and value added in the majority of EU food sectors. This concentration is partly caused by a wave of mergers observed in the period 1987-1990. It was also noted that the food sector includes more big mergers than any other sector. These developments are expected to lead to a more radical change in the structure of the food industries than in the rest of the manufacturing 'since the large firms are those which can mainly affect competition in industries producing consumer commodities by applying costly product differentiation strategies' (1995: 4-5). The tendency of further concentration of food processing industries indicates these industries aim for gaining from economies of scale which are likely to exist. These companies are most probably able to influence supply and prices on the markets.

McCorriston and Sheldon (1996) observe a relatively high concentration in each of the sub-sectors of food manufacturing across the EU. Similar to the food processing sector, food retailing also shows signs of market dominance by a small number of retail outlets. The authors characterize the sector by successive stages of production and distribution with imperfect competition being the feature of each stage. They illustrate that the presence of successive-oligopolistic markets and the contractual arrangements between each successive can have important bearing on the welfare outcome following policy reform: compared to standard analysis (i.e. consumers and producers face the same price and perfect competition) consumers gain less and firms proportionately more from a policy-induced price decline when markets become less competitive (McCorriston and Sheldon, 1996:14-18).

The third group of products - *differentiated primary products* - takes an intermediate position between the two former groups of agricultural products. Products belong to this category if some degree of product differentiation is possible but production costs are also important. Products can be differentiated through quality differences, energy contents, attributes like taste and so on, and to geographical position (local brands) while production costs are mainly dependent on natural resources (climate and soil) and costs of production factors. Examples of this category could be cheese and beef, both products where quality and tast differences matter. One could also think about fruit and vegetables which by its character of great variety could belong to this group. Further, products could be distinguished by the production methods used (e.g. by

organic farming) which gives them differentiated primary product features. The market structure may be characterized by monopolistic competition because there are many firms which have an influence on the price. This means also that the market structure takes an intermediate position between perfect and oligopolistic competition.

Importance of determinants of trade for each group of products

The three groups of agricultural products identified constitute the basis for our analytical framework because we assess the importance of each of the determinants for trade patterns of these three groups. The results are presented in figure 2.3. Each column identifies the important determinants of the trade flows of the three general groups of agricultural products.

The second column in figure 2.3 shows that for *undifferentiated primary products* production and transportation costs are very important because price competition characterizes the international trade process. Factors that are assessed to be potentially important for *undifferentiated primary products* are; natural resources, factor endowments, process innovations, knowledge spillovers, trade policies and physical infrastructure. Human capital, internal and external economies of scale, and product innovations were considered to be of less importance.

Product differentiation by improving the quality level and introducing new varieties is important for *processed food products*. In contrast with the undifferentiated primary products, human capital, knowledge and imperfect competition are concluded to be very important determinants for trade patterns while natural resources, factor endowments and process innovations are judged to be of lesser importance. The physical and knowledge infrastructure are again assessed to be important.

The *differentiated primary products* possess again an intermediate position. Both costs and product differentiation aspects are of some importance. Therefore, there is no single feature or coherent group of determinants that dominates trade in these products. Cost aspects are important, but slightly higher production costs can be compensated by a certain degree of product differentiation. The other way around is also possible: a lower degree of product differentiation can be compensated by lower costs.

Another way to interpret our figure and the three kinds of agricultural products is to see the three groups of products as a *continuum of goods*. On the one extreme end of the spectrum there are homogeneous goods (i.e. undifferentiated primary products) where cost competition is the only viable strategy and at the other extreme there are differentiated products (processed food products) where product differentiation is the most important strategy. At the same time, one should be aware of the fact that differentiated or processed products could have a bulky character too, and products could differ in bearing differentiating attributes, processed with use of more or less advanced technology and differences in value added. This indicates that even *within* a group of products one could see a continuum of goods.

2.2.3 Matching

In this subsection we match the important characteristics of the agricultural and food products with trade theories. This matching results in a concept that describes which theories are expected to be potentially useful in explaining trade in agricultural and food products. A glance at table 1 shows that for each of the three groups various determinants are important. The problem is that in most cases these determinants are not covered by one theory, because the trade theories focus more or less on one determinant or on a few determinants that are interrelated. There are two possibilities to deal with this problem. First, evaluate which of the determinants of trade is most important and use the corresponding theory (i.e. assume other determinants to be equal across countries). Second, investigate in an empirical way which determinants turn out to be most important for the product under consideration. For example, by a simple regression between trade flows and some proxies for the relevant determinants. The first option mentioned may be based on personal opinions by the author(s), which may be argued, while the second possibility may turn out to be disputable because of questionable proxies or lack of adequate data.

This having been said we still attempt to confront features of the three groups of agricultural and food products with trade theories. When we match these characteristics with the trade theories we may expect that the traditional theories are well suited to explain trade in the undifferentiated primary commodities. Contrary to this, we expect trade in processed food products can be explained by the modern theories and the dynamic evolution of these trade patterns by the new growth theories. For the differentiated primary products it appears much more difficult to match the features of these products with one school of thought. In some cases the traditional theories are more appropriate, in other cases the modern trade theories are better suited and sometimes both schools of thought require consideration.

Figure 2.3 Matching between factors of importance in analysing trade and (groups of) agricultural products considered

Features of products, markets and countries	Importance of features as determinants of international trade			Trade theories most explicitly linked to the feature
	Undifferentiated Primary Commodities	**Differentiated Primary Products**	**Processed Food Products**	
Natural Resources (climate, soil, rivers, geographical position)	Very important, but advances in technology (e.g. biotechnology) reduce importance	Important, but advances in technology (e.g. biotechnology) reduce importance	Little importance, but varies with mobility characteristics (e.g. weight, perishable) of primary products	Ricardo
Production factors				
Factor endowments (land, labour, capital)	Very important	Important	Little importance, but varies with mobility characteristics of primary products	Heckscher-O-S
Human capital/knowledge	Some importance, especially skills of production workers		Important, especially management (coordination, organisation) and research and development skills	Modern trade theories / Growth theories
Technology:				
Internal Economics of Scale (firm level)	Little importance		Some importance, some economics of scale in production/R&D/marketing	Internal economies of scale approach / Growth theories
External Economies of Scale (industry level)	Some importance; when production needs for example specialized inputs			External economies of scale approach
Technology differs between countries	Little importance	Some importance	Important	Ricardo / Neo-technology / Growth theories
Process innovations	Very important, minimum cost is only feasible strategy	Some importance		Neo-technology / Growth theories

Process innovations	Very important, minimum cost is only feasible strategy	Some importance		Neo-technology Growth theories
Product innovations - quality enhancing - more product varieties	Little importance (e.g. transportation)	Important	Very important	Neo-technology Growth theories
Knowledge spillovers	Very important: technology mobile across countries	Important		Neo-technology Growth theories
Consumer preferences				
Income elasticity	Low income elasticity. A characteristic of food products is that food expenditures as a share of income decline as income grows (Engels Law).	Low/moderate income elasticity	Moderate income elasticity	Neo-technology Evolutionary growth theories
Market structure				
Perfect competition	Very important	Some importance	Not important	Traditional trade theories
Imperfect competition	Some importance (e.g. a firm/country dominates trade because of its size or export policy)	Some importance	Very important	Modern trade and growth theories
Government				
Policies (e.g. trade policy)	Very important: trade policies may determine trade patterns	Importance varies: policies greatly influence trade patterns. But, often the policy impacts are indirect.		All trade theories
Physical infrastructure	Very important to cost competitiveness	Very important to cost competitiveness and product differentiation		Ricardo
Knowledge infrastructure	Important to process innovations	Important to process and product innovations		Neo-technology and evolutionary growth theories

3. APPLICATION OF TRADE THEORIES IN ANALYSING AGRICULTURAL TRADE

3.1 Introduction

This section analyses the application of international trade theories to agricultural trade. As shown in our survey, international trade theories can be classified in two major streams: the traditional and modern trade theories. The use of traditional trade theories in the field of agriculture is the subject of section 3.2. In section 3.3 the application of modern trade theories in analysing agricultural trade will be investigated. The relevance of the new growth theories in analysing agricultural trade will be explored in the concluding section of this chapter.

3.2 Use of traditional trade theories in the field of agriculture

3.2.1 Introduction

Traditional trade theories are the classical Ricardian and neo-classical H-O-S theorem. The central focus is on comparative advantage which notion is related to relative costs of production (relative labour productivity). As known from the survey of trade theories, differences between countries in labour productivity are the main drive for trade in the Ricardian theory. Labour productivity differs between countries because of differences in technological knowhow and applications, as well as in differences in natural endowments. Sometimes, Ricardian goods are considered goods for which natural production circumstances (soil, climate, geographical position) are the main determinants of trade patterns. Specific location-bound factors are climate, natural resources, and the geographical situation. Obviously some of these factors are of major importance for the allocation of agricultural production.

According to the H-O-S explanation of trade, comparative cost differences are caused by differences between countries in relative factor endowments and in factor intensities between products. According to the H-O-S theorem every country has free access to technology. Footloose products - these are products not bound to a specific location - fit in H-O-S theory criteria and are therefore called H-O-S goods. These goods may have an agricultural base and therefore the H-O-S theorem may be of use in explaining agricultural trade flows too.

3.2.2 Ricardo: natural resources and technology

As already said, differences between countries in labour productivity, according to the classical theory (Ricardo), is the drive for trade. Labour produc-

tivity differs between countries because of differences in technological know-how and applications, as well as in differences in natural endowments. In many studies on agricultural trade analysis and international competitiveness, productivity - or differences in productivity levels - is mentioned as an important indicator of competitiveness (see e.g. papers on the causality between productivity and exports in agriculture, like Arnade and Vasavada, 1995 and its references) and thereby a major reason for trade. The reasoning behind this is that the higher the productivity level, the lower production costs and the stronger competitiveness of a product, sector or country. In Bredahl et al. (1994), several studies of the competitiveness of the food and agricultural sector of the USA, Canada, New Zealand and Denmark are presented. In all these papers a different definition of competitiveness is given. However, most of them explicitly focus on differences in productivity levels of the food(sub)sector(s) in one country versus others as the main indicator of competitiveness.

Some studies not only measure productivity differences but also explicitly try to find explanations for the reasons why levels of productivity differ between countries. An example of such a study is done by Baily and Gersbach (1995, as referred to by Traill, 1996). These authors carried out a comparison of labour productivity in Japan, Germany and the US for a number of manufacturing sectors, including food and beer. The US was the most productive in both of those sectors, food productivity in Germany reaching 76% of the US level while in Japan it was only 33%. For beer the figures were 44% for Germany and 69% for Japan. The explanations found by both authors were the differences in output mix, in output variety, in economies of scale, and in capital intensity. Surprisingly - from the viewpoint of the theory by Ricardo - labour skills and access to proprietary technology were found not important in explaining productivity differences. Instead, elements known from new trade theories seem to be more important than those indicated by Ricardo.

Comparative cost advantages
Based on the traditional neo-classical H-O-S model, differences in factor endowments induce differences in production costs and this will be the drive for trade. The optimal pattern of production and trade for a country is determined from a comparison of the opportunity costs of producing a given commodity with the price at which the commodity can be imported or exported. A methodology to quantify comparative advantage which is based on this theoretical framework is called the Domestic Resource Costs (DRC). The DRC approach involves identifying those branches which make the greatest contribution to the national income valued at competitive i.e. world market prices, relative to the inputs of domestic resources such as capital and labour that they require. The proposition is that, for the production of one unit of a commodity, the value of production at international prices minus the cost of intermediate inputs in production at international prices must cover the cost of the primary factors used in production. The compensation of these primary factors is equal to the value of production at domestic prices. In a simple formula: DRC = value added in domestic prices / value added in world prices. A value of the ratio between 0 and 1 indicates a favourable competitive position of a product or

sector. The DRC indicator is widely used to measure comparative advantage, either in academic research as well as in applied work and/or policy analyses executed or sponsored by international agencies as World Bank, FAO and OECD (see Masters and Winter-Nelson, 1995, for references and a critical examination of the DRC ratio) 1).

McCalla and Josling (1981) present an extended bibliography of a selection of work on many aspects of international agricultural trade, published between 1970 and 1980. One of these aspects is the application of the H-O-S theory of international trade to agricultural trade. Some of the selected studies focus on the sources of comparative analysis for particular agricultural products, like rice, cocoa, and coffee. Others discuss the limitations of this concept in the imperfect markets characterizing most of the agricultural products. Also, a sampling of empirical agricultural trade models written during the 1970s has been included. Some of the work selected by both authors is discussed briefly below in order to shed a light on the mainstream approaches in analysing international agricultural trade before 1980.

3.2.3   The appropriateness of the Heckscher-Ohlin-Samuelson theory of international trade to agriculture

In the 1950s and 1960s, discussion on the relevance of the theory of comparative advantage for agriculture took place in the context of thoughts about economic development, especially focusing on problems of underdevelopment in Latin America and newly established countries in Africa and Asia. Much of the discussions, contributing to the establishment of the field of development economics, concentrated on the question how to spur economic development in less developed countries. There was the dispute whether developing countries should follow stages of development that also took place in the more developed countries, and if so, how. These stages of development identified imply a switch of resources along a development path from agriculture to industrial production. Such a switch would be beneficial to developing countries as there was a tendency of the terms of trade to deteriorate for primary products, monopolies in industry in developed countries would grab benefits of trade at the expense of agricultural exporters, etcetera. This discussion was also strongly related to a discourse on trade implications of the economic development in underdeveloped countries, i.e. competitiveness between industrial countries and the rest of the world. There were thoughts that developed countries were gaining from the specialization of developing countries in agricul-

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1)   The DRC method is much used but has also some limitations, e.g. with respect to the determination of shadow prices and exchange rates. The limitations of the DRC relative to formal models that require more data are well documented by e.g. Towers (1992) . Masters and Winter-Nelson (1995) show that the results of DRC can be improved by using the same data in an alternative formula. Both authors demonstrate that the DRC is biased against activities that rely heavily on domestic factors (land and labour) and overstates the relative profitability of activities using large amounts of tradable inputs.

tural raw goods, while this specialization patterns was not beneficial for the developing countries themselves. In this context Gotfried Haberler - a Harvard professor on international economics - contributed a paper to an international congress in 1966 on the relevance of the theory of comparative advantage to agricultural production and trade. This paper and the discussion that followed may act as an illustration of the arguments used in this debate and will be briefly presented below.

Haberler's arguments and criticism to his viewpoints

Haberler (1966) argues that old established patterns relying heavily on agricultural and raw material exports by many of the underdeveloped countries are *not per se* detrimental to economic development. As a consequence his arguments can be interpreted as a criticism of the effort of many developing countries (at that time) to switch resources from agriculture and to build up an industrial production structure.

In his paper, Haberler concludes that 'the theory of comparative advantage applies to the modern world, including modern agriculture'. Haberler states that the theory is correct in its own assumptions and he finds, although some deviations of the assumptions from the facts are unavoidable, the assumptions still realistic enough to have explanatory value. The assumptions of the theory of comparative advantage are, in the words of Haberler, perfect competition and absence of external economies. He rejects criticism on the relevance of the comparative advantage theory which is that the real world is not according to the assumptions underlying the theory of comparative advantage, but instead imperfect competition prevails, external economies exist, etcetera. Although Haberler recognizes that the 'ideal' assumptions are never fully realized in the real world, he states that the mere reference to the large number and pervasiveness of those 'impurities' - existence of monopolies, price inflexibility, etcetera - does not invalidate the theory. Haberler claims that international trade is likely to diminish or reduce some of the imperfections. As monopolies and oligopolies tend to be undermined by freer trade, Haberler states that free trade is the best anti-monopoly policy. Haberler finds no evidence in arguments against the relevance of the theory of comparative advantage. Still, he wants to qualify the theory of comparative advantages at one point: 'Allowance must be made for the type of external economy on which the infant industry argument for protection is based: the training of a skilled labour force in a broad sense, including the 'learning process' of supervisory and entrepreneurial labour. Policies to achieve this aim can be aptly described as 'investment in human beings' implying, as every investment does, a temporarily sacrifice' (1966: 36).

At the conference where Haberler presented his paper his viewpoints were criticized by a number of agricultural economist. For instance it was found disappointing that Haberler had examined some of the major assumptions of the theory without empirical evidence where agriculture was concerned. In Haberler's analysis, there was no statistical verification of agricultural trade that bear some relation to comparative advantage. Furthermore, Haberler did not analyse the relevance of the assumptions of the theory for agriculture and did

not point at the implications of the situation in which the assumptions deviate from the observations in the agricultural markets. It was found most surprising that Haberler excluded governmental action in the field of agriculture i.e. he did not pay attention to farm price support schemes and other types of government-managed or controlled agriculture and their impact on international trade. The Haberler paper was found to be too theoretical, not giving answers to the question who gains what and how much from agricultural trade based on comparative advantage. According to those who commented on Haberler's paper agriculture is far from being a field of free competition; its market is full of imperfections at all levels, which implies that the relevance of the theory of comparative advantage is less pronounced than Haberler states.

The discussion on Haberler's contribution reveals that already in the sixties there is much disagreement on the relevancy of the H-O theory for explaining agricultural trade. Empirical validation of the relevance of the H-O theory to agriculture seemed to be very difficult. It was recognized that the market is far from perfect competitive and external economies of scale do matter and should be taken into consideration. However, it was considered impossible at that time to bring these thoughts and observations into a modelling framework.

Other works

The bibliography by McCalla and Josling (1981) on the application of the comparative advantage approach to agricultural trade learns that - although it is a selection of published work - there is only a limited number of studies focusing on the applicability of the concept to agriculture. Only two studies mentioned in the overview deal with agriculture in the EEC. De Veer (1978) analyses the comparative advantages of the primary agricultural sector in the EEC. In his contribution he stresses the availability and quality of natural resources as important factors in the location of agricultural production in the EEC, more important than the price ratio of labour to capital. Basically De Veer relies on a Ricardian type of explanation of agricultural trade. De Veer says that, in an international framework, Western Europe as a whole has a comparative advantage for intensive grassland exploitation and fodder crops as a basis for the dairy industry. However, the considerable milk surplus (already prevailing in the early 1970s) cannot be sold on the world market at a price required to meet costs of production. De Veer concludes that prospects for commercial exports of dairy products from the EEC are small. Generally speaking, De Veer is rather pessimistic about the comparative advantages of European agriculture, pointing at the importance of interventionistic price policies for main agricultural products.

In his effort to analyse the competitive position of the food and drink processing industry in the EEC, Powers (1978) identifies several determining influences of trading advantages. He points at natural advantages in producing raw material for processing, on geographical location (nearness), and on what he calls 'developed advantages', which include efficiency in production, marketing and distribution ('advantages which do not arise from natural conditions'). Further, he considers externalities and institutional advantages such as

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legal and tariff arrangements. Institutional advantages of a different kind are historical and cultural influences. Power identifies the trading advantages of the EEC's food and drink industry arise from locational, cultural and historical factors. According to Power the industry 'has also advantages of already possessing an economically developed and experienced industry well equipped with skilled management and labour, and benefitting from 'externalities' such as the back-up of highly developed packaging and food machinery industries, and considerable R&D effort in the food sector generally' (1978:17). The analysis of Power shows a mixture of Ricardian type of explanations for agricultural trade, some elements of the H-O theorem and aspects noticible in modern trade theories. Even elements from new growth theories, including the evolutionary growth theory are traceable. All in all, his analysis of the competitiveness of EEC food and drink industry indicates an eclectic approach in identifying major explicating factors.

Modelling international trade in agricultural products before 1980s...
The bibliographic overview by McCalla and Josling on trade models and empirical methods (1981: 200-207) shows there is vast literature on this subject. Sarris (1981) provides an overview of conventional approaches to modelling agricultural trade, taken in the sixties and the seventies. His essay is narrowed by concentrating on methodologies and models dealing with individual and relatively homogeneous commodities. Nevertheless, his overview focuses on the most important of the existing methodologies for the empirical analysis of internationally traded agricultural products and is therefore highly relevant.

Sarris illustrates that the bulk of empirical studies on agricultural trade problems has remained within the 'competitive passive-government mode' (1981:6) while 'the typical pricing model assumed is a perfect competitive one (1981:90). Besides market-oriented reduced form models, nonspatial and spatial price equilibrium models, Sarris surveys the methodologies of market share analyses and Armington type models. The appropriate choice of an empirical framework must be dictated by the question the analyst wants to answer, according to Sarris. This is much in line with Leamer's analysis with respect to appropriateness of trade theories to actual circumstances (see Chapter 1). Each of the methodologies reviewed can answer some (group of) questions, but no empirical method is appropriate for everything. Sarris stresses that most questions in the sphere of international agricultural trade concern the impact of domestic policy measures on the rest of the world and vice versa, with respect to price formation, trade patterns and trade flows. However, despite the dominance of these policy related questions Sarris concludes that 'all models surveyed suffer from inadequate, if any, treatment of foreign reactions to individual trade policies (1981:109). He recommends the development of a framework for endogenizing the oligopolistic structure of many international agricultural markets. This is based on the observation and recognition that most international agricultural markets exhibit oligopolistic structures, rendering the modelling of the price formation mechanism very difficult. Sarris therefore argues that empirical trade models must be designed based on explicit market behaviour rules like, e.g., price leadership by one of the major trading countries.

While the conceptualization and the theory of such models has not been re-searched much, Sarris states that 'empirical models based on oligopolistic struc-tures are almost nonexistent' (1981: 92).

... and since the 1980s
Since the call of Sarris for a more appropriate inclusion of market behav-iour of the actors involved in the modelling tools, there has been done some work to model imperfect competition in agricultural markets (see below in section 3.3). Nevertheless, the use of traditional concepts in analysing trade in agricultural products still has been common in the 1980s and 1990s. This comes out very clearly when the approaches underlying studies on consequences of domestic protectionistic policies on international agricultural trade and welfare are investigated. In the 1980s many research efforts were spent on analysing the way and extent agricultural world markets were distorted through the use of (non-)tariff barriers and export subsidies. Models were designed aimed at measuring the gains of trade liberalization. Most quantitative analyses of inter-national farm and food policy reforms have focused on trade in raw agricul-tural products. Empirical research on the impact of trade liberalization due to the GATT Uruguay Round generally rests on the traditional theory of compara-tive advantage (e.g. see Tyers and Anderson, 1992).

3.3   Usability of new trade theories in the field of agriculture

3.3.1   Introduction

Only since the beginning of the 1990s research attention has been given to the possible application of concepts from the new trade theories to agricul-tural trade and trade policy analysis. However, little work has been done to date. In a recent paper Sheldon and Abbot (1996) observe that the economic analysis of international markets for processed agricultural products, manufac-tured foods and other high-value products still has received little attention in the agricultural economics literature, although it is recognized that the impor-tance of these products in international trade is increasing (see also chapter 2). The mainstream of agricultural trade analysis is still based on the traditional theory of comparative advantages and according to the neo-classical approach. For instance, virtually all of the empirical research on the impact of trade liber-alization due to the recent GATT round was based on this theoretical frame-work, although the limitations of the most commonly used (static, determinis-tic, reduced-form, supply-demand) trade models are recognized (see Peterson et al., 1994). However, as Sheldon and Abbott also note, the characteristics of the food processing sector suggest that these models may not be especially relevant for understanding the nature of trade and international competition in manufactured food products (1996:2). This section highlights some of the prominent characteristics of trade analysis with respect to agricultural and food commodities using elements and concepts from the modern trade theoretical insights.

An important contribution was made in this field by the International Agricultural Trade Research Consortium (IATRC) 1) which organized and sponsored a symposium in 1989 to explore the implications of the new trade theory for agriculture (Carter et al., 1990). This organization commissioned several paper contributions which systematically explore the conceptual and empirical dimensions of the new theory and try to determine the potential application to agriculture trade and trade policy analysis 2). It was stated that 'the new trade theories have important (...) implications for agricultural trade research. After all, agricultural trade is characterized by differentiated products, imperfect competition, and strategic trade policy such as export subsidies, import quotas, etc. Virtually none of the agricultural trade modelling to date has incorporated these new theoretical developments' (Carter et al., 1990:2). Yet some work already had been done to include the concept of imperfect competition in agricultural trade analysis.

3.3.2 Modelling international trade in agricultural commodities under imperfect competition

Recognizing the link between imperfect competition and international trade policy a diverse set of models of imperfect competition have been developed to explain price formation in international agricultural trade. McCalla (1966) has been a pioneer by suggesting that the grain trade may be oligopolistic because of the dominance of a few exporting countries in the world grain trade. Since his early contribution in this field, more studies considering market power and imperfect competition in agricultural markets focussing their analysis on the case of wheat followed. Among them, authors like Alaouze et al. (1978), Carter and Schmitz (1979), Sarris and Freebairn (1983), Paarlberg and Abbott (1986), Kolstad and Burris (1986) and Thursby and Thursby (1990) may be mentioned.

MacLaren (1990) gives an update of the methodologies used in trade analysis in the 1980s and introduces some of the implications of new theory by focusing on modelling imperfect substitutes in agricultural trade. From the overview of MacLaren it becomes clear that at the end of the 1970s the concept of imperfect competition was introduced into agricultural trade analysis. Several authors stressed the weakness of the spatial equilibrium model of trade in homogeneous products by introducing theoretical assumptions underlying a model of trade in a product which is differentiated by the location of its production. By assuming that products differentiate by country of origin (following Armington, 1969) differences in consumer preferences are an important

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1) The IATRC is a group of economists from around the world who are interested in fostering research and providing a forum for the exchange of ideas relating to international trade of agricultural products.
2) The contributions of MacLaren (on modelling imperfect substitutes) and of Thursby (on strategic trade policy) to this symposium will be discussed briefly in following sections.

sources of trade. The Armington-model has been used in agricultural trade modelling for example by Grennes et al. (1978), Johnson et al. (1979), Sarris (1983), Thursby et al. (1986), Goddard (1987), Alston et al., 1990) and Duffy et al. (1990). Empirical literature to illustrate the way in which product heterogeneity has been specified is among others De Gorter and Meilke (1987) (analysing the EC's intra-industry trade in wheat), Veeman (1987) (elaborated a pricing model to estimate the implicit prices of characteristics of wheat traded internationally), and Anderson (1988) (specified a differentiated-products model to investigate for the USA the efficiency losses of the use of import quotas on foreign cheeses). These models expand the range of explanations for the gains of trade (namely product differentiation and internal economies of scale) and generate the conclusion that free trade is not the optimal policy.

During the 1980s, theoretical models which include differentiated products have been formulated largely to explain the existence of intra-industry trade. The other explanation for intra-industry depends on price discrimination. By segmenting their markets, firms can restrict their markets in the domestic market and sell abroad with lower markups. A (first) example of this approach to trade in agricultural commodities is the study by Pick and Park (1991).

Pick and Park developed a model of pricing-to-market (PTM) behaviour to test for imperfect competition in agricultural trade 1). Exporters may exercise market power by adjusting prices to different export destinations, resulting in a form of price discrimination. Pricing to market behaviour pertains to decisions by exporters to maintain or even increase export prices when facing currency depreciation relative to the importer's currency. Pick and Park apply a PTM-model to US exports of wheat, corn, cotton, soybean and soybean meal and oil. In the 1970s and 1980s, the US has been a major exporter of these commodities. The results of this analysis rejects the hypothesis that the export pricing decisions by US firms are consistent with price discrimination across destination markets for cotton, corn, and soybeans, or, to say it in other words, US firms did not exercise market power in these markets and the study results indicate that markets are competitive. Results are ambiguous for soybean oil, cake, and meal markets. The strongest evidence against the competitive market structure is obtained for international trade in wheat, the US being a major exporter discriminating heavily across destination markets. However, both authors also show that China and the Soviet Union, two largest importers of wheat, obtain lower prices for their imports which suggests some exercise of mono- or oligopsony power in international wheat trade.

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1) The authors build on the modelling work by Knetter (1989) who has attempted to test Krugman's (1987) PTM hypothesis on market power and price discrimination. Krugman states that tests of imperfect competition in international trade can be based on the observed pricing decisions of exporters.

3.3.3   Strategic trade policy

In agriculture the role of government intervention is widespread. Based on the neoclassical theory of trade, such policy is very distorting and detrimental to global welfare. The area of strategic trade theory is generally considered to be a re-appraisal of the role of government in international markets: under some circumstances, protection may be justified, at least from a national viewpoint. While the strategic trade theory seems to be well established in the international economics literature now, not much work has been done yet on the applicability of these models to agricultural and food trade. Yet, besides the importance of governmental policies in agriculture, the tendency that food industries in the EU, the US and other developed economies have imperfectly competitive market structures characterized by high seller concentration, some degree of plant level economies of scale and product differentiation suggest that there is potential for strategic interaction. Out of the small number of studies that applied strategic trade analysis to food industries, Thursby (1988), Thursby and Thursby (1990), Krishna and Thursby (1990) and McCorriston and Sheldon (1992) are the most notably contributions. Some of these will be considered briefly below.

Thursby and Thursby (1990) examine the relevance of 'strategic trade policy' literature and applicability of results from this type of analysis for agriculture. The purpose given for the study is to ascertain the nature of exporter competition as a basis for possible future policy applications. They present an agricultural trade model in which they include market (firm) behaviour with imperfect competition. In their model, two countries export a (perfectly) competitively produced product, wheat. One of the countries exports wheat through a marketing board while in the other, the export industry is composed of large private firms. The authors use conjectural variation parameters to allow for a range of competitive assumptions, including Cournot and Bertrand behaviour, which means that the exporters of wheat can possibly compete on prices and/or outputs. The model is calibrated to market data for Canadian and US exports of wheat to Japan. Their results suggest that the Canadian-US rivalry in the Japanese wheat market is more competitive than Cournot competition. In other words, the interactions of both competitors in wheat exports to Canada can be characterized as a Bertrand game (= imperfectly competitive firms take each others' prices as given and they compete by vary their export volumes). So, price is the strategic variable and determines the optimal policy, according to this model. The results should, however, be interpreted with very much caution, as the conclusions are highly dependent on the assumptions used. Furthermore, the authors receive more critical comments on the conjunctural variation method applied, the (derived) data used, and on the specifications of (some of the) equations (Veeman, 1990: 107-111).

McCorriston and Sheldon (1992) discuss some possible applications of strategic trade theory to the agricultural and food sector. They indicate that the theoretical framework of strategic trade theory may be useful in two types of related empirical analysis. First, the analysis could be used to evaluate the extent to which strategic rent-shifting may occur in a specific food processing

sector in a specific country. Second, the analysis could be used to evaluate trade interventions that have already been implemented. In that case the objective of empirical work might be to compare actual interventions with what strategic theory would predict to be the optimal levels of intervention. The authors outline a specific application to the US-EC cheese processing sector. As the (limited) empirical work has focussed almost exclusively on tariff and/or subsidy issues in industrial markets, such a case study is considered interesting as the US uses a system of import quotas as a means of supporting the dairy market and in both US and the EU - the main competitor on the international market - cheese processing industries are to varying degrees imperfectly competitive. The welfare outcome of the optimal import quota is compared with the quota regime in use, using a standard partial equilibrium model of differentiated oligopoly. Results indicate that the imposition of an optimal import quota would increase US national welfare relative to the free trade case. So, national welfare can be increased if such a trade restriction is adopted, which is consistent with the overall prediction of strategic trade theory. Results also indicate that the actual import quota applied does not increase welfare relative to the free trade case, suggesting that the current level is to stringent and the restriction should be relaxed to capture rents fully.

Strategic trade theory has also been used in some studies in search of the rationality behind the agreement on agriculture in the GATT by taking an explicitly game theoretical approach (e.g. Johnson et al, 1993; Abbott and Kalio, 1996). For instance, Abbott and Kalio utilized a stylized model of world wheat trade to illustrate under differing institutional arrangements (game structures) the levels of export subsidies (or taxes - the strategies), net exports and the political payoffs for four regions or players: US, EU, CAIRNS and importers. Their simulations of alternative GATT arrangements show that, given political payoffs, the US-EU cooperative solution in which export subsidies persist is optimal relative to free trade and unilateral reform. Game theory may be useful in understanding the nature of market outcomes when policies of export subsidies matter. But although, as Abbott and Kalio mention, issues of imperfect competition and strategic trade policy interaction lay at the heart of the GATT Uruguay Round negotiations, both authors also stress that incorporating game theoretical approaches into trade policy analysis is not common, because of its complexity. Most models used to assess trade liberalization impacts assumed competitive world markets without explicitly examine the game theoretic aspects of market outcome.

It appears that strategic trade theory does has some relevance for agricultural trade policy research when markets can be characterized by imperfect competition. However, in applying these theories some caution is recommended (see also section 3.1.3 in Van Berkum and Van Meijl, 1998). The benefits are small and may be negated by inappropriate policy selection, other government retaliation and general equilibrium effects that divert resources away from other sectors. Moreover, applying these theories may have important income distributional effects which one should be aware of.

3.3.4 Intra-industry trade in agricultural and food products

Studies using the concept of intra-industry trade in explaining trade in agricultural and food commodities have not been conducted and reported on until in the 1990s. Yet, this type of trade seems to be of an increasing importance, also for agricultural and food commodities. The scarcely published studies (so far only five, to our knowledge) elaborating on this concept of intra-industry trade for the agricultural and food industries are briefly summarized below.

A paper by McCorriston and Sheldon (1991) was among the earliest contributions on the analysis of 'two way' trade flows in agrifood products. Their paper examines trade in a sample of high-value products for the US and the EC, using indices of intra-industry trade and intra-industry specialization. The results indicate that for total trade in 1986, the EC exhibited more intra-industry trade across the sample than the US, although much of this was due to trade among EC countries. Further, over the period 1977-1986, the EC indicated a greater tendency towards intra-industry specialization in its geographical pattern of trade than the US.

McCorriston and Sheldon used the Grubel-Lloyd index as the measure for intra-industry trade. As this index gives an indication of the structure of trade in any given year, it does not allow tests of statistical significance for changes in trade patterns over time. In order to deal with this, McCorriston and Sheldon present an adjustment of the Glejser, Goosens and Vanden Eede measure. This is an index of either export or import specialization that measures the changes in an individual country's trade relative to changes in total trade of a group of countries.

For the ten processed agricultural product groups reviewed by McCorriston and Sheldon the Grubel-Lloyd index indicates that in 1986 the structure of trade with the world for the EC, including intra-EC trade, was of a intra-industry nature. The high levels of intra-industry trade for the EC appear to be influenced by its integrated nature: focusing on external trade of the EC, the results showed lower levels of intra-industry trade for all product groups, while for seven groups trade tended to be rather of inter- than of intra-industry nature. In examining the changes in trade between 1977 and 1986, total trade with the world tended to be inter-industry specialization both for the EC and the US. Assuming that trade in processed products between developed countries may differ from the general pattern characteristics of world trade, the measure was used to focus on geographical patterns of trade for the US and the EC. The results indicated different general patterns of specialization for the US and the EC. Specifically, for all processed products reviewed changes in EC specialization were largely intra-industry in nature, particularly with respect to intra-EC trade and trade with other European countries, while for the US it was predominantly inter-industry in nature (with the exception of exports to Canada which indicated a trend to intra-industry specialization).

McCorriston and Sheldon not only tried to indicate the importance of intra-industry trade but also suggest some reasons for the differences in spe-

cialization observed in the US and the EC. They state that two factors, the role of distance to foreign markets and access to markets, may be the most important factors in explaining the growth and levels of intra-industry trade. For the EC, economic integration, proximity to community and other European countries as well as economic ties with ex-colonial countries are likely to influence the extent of intra-industry trade, while proximity to markets is likely the main explanation for intra-industry specialization observed between the US and Canada. Some industry characteristics may be important too, as direct foreign investment tends to act as a substitute for international trade, but the precise relation is not clear yet (see also Traill, 1996).

McCorriston and Sheldon conclude that the analysis of processed agricultural food markets is an important topic for future research. Trade in processed agricultural products is clearly the most dynamic sector of world agricultural trade, as can be deduced from FAO-data (see also Elleson, 1988). However, there is not much work done yet to investigate the level and determinants of intra-industry trade in processed agricultural commodities. Furthermore, since intra-industry trade and specialization appear to be increasingly important features of agricultural trade in processed agricultural products, the policy and welfare implications of such trade also should be considered. This is particularly important regarding the effects of international competition, the effects of establishing regional trading blocks and the role of government intervention (1991: 183).

Since the pioneering paper by McCorriston and Sheldon some further research work has been done on intra-industry trade in agricultural and food products. Christodoulou (1992) examines levels and determinants of intra-industry trade in the case of EEC red meat. The extent of the occurrence of IIT among individual EEC member states has been measures by using the Grubel-Lloyd index. IIT was measured for beef and pork and for three processing stages. It appears that major exporting countries are also performing the most considerable two-way trade flows, in many cases amongst them, while their are few where inter-industry trade predominates. Results from Christodoulou's analysis suggest that countries' cultural and economic convergence as well as the imperfectly competitive structure of the market due to product differentiation significantly explain intra-industry trade. Both the demand (country specific characteristics) and supply (industry specific characteristics) side are relevant in explaining intra-industry trade patterns of trade in the European meat market. On the demand side, the most important factor is the taste overlap captured by the similarity both in economic and cultural variables, as suggested by per capita incomes and geographical proximity respectively. On the supply side imperfect competition significantly explains intra-industry trade.

A rather comprehensive study with a quite new approach to analyse IIT has been undertaken by Hirschberg, Sheldon and Dayton (1994). These authors analyse the determinants of bilateral IIT in the food processing sector for a sample of 30 countries over the period 1964-1985 by using a pooled cross-section/time-series analysis and a weighted, fixed effects tobit procedure. Hirschberg et al. follow Helpman and Krugman (1985), in stating and testing three hypotheses with respect to the relation between intra-industry trade and

factor endowments. These hypotheses are: firstly, the level of intra-industry trade will be higher (lower), the greater the equality (inequality) of relative factor endowments between the countries; secondly, the degree of intra-industry trade will be higher (lower), the smaller (greater) the relative size of the capital-rich country, size measured by GDP; and thirdly, the degree of intra-industry trade for a specific country will be positively associated with endowments of capital per worker, again measured by a country's per capita income. The results of the analysis of Hirschberg et al. provide support to two predictions of the Helpman-Krugman model, indicating that IIT in food processing is a positive function of a country's GDP per capita and equality of GDP per capita between countries. In addition, it is also found that such trade is strongly influence by distance between trading partners, membership in customs unions and free trade blocs, and also exchange rate volatility. Distance between countries has a negative impact on intra-industry trade while membership in either customs union or free trade area has a positive effect on intra-industry trade. It was also found that long run exchange rate variation tends to lessen trade.

Pieri et al. (1996) contributes to this literature by analysing the factors which explain cross-country variations in levels of IIT in the EU dairy products industry over the period 1988-1992. A key hypothesis of their work is that retailing structures play a role in explaining the importance of IIT. The authors argue that more concentrated retailing structures contribute to IIT by reinforcing the taste of variety of final consumers and by reducing the transaction costs in international trade.

Gomes da Silva (in Traill, 1996: 6) estimates an increasing level of intra-industry trade in food, drink and tobacco industries in the EU-12 countries in the period 1980-1992. Using the Grubel-Lloyd index, estimates were calculated at the 4-digit SITC level. In all countries but one (Denmark) the indices increased, most notably in the Mediterranean countries Spain, Greece and Portugal where IIT was previously least important. Although these results suggest that food trade is increasingly of an intra-industry type involving processed foods, the results also indicate that intra-industry trade is not dominant yet, because indices for seven countries and for the EU as a whole were still below 0.5.

3.4 Relevance of Neo-technology trade and new growth theories for agricultural trade

There are only a few empirical studies that have tested the influence of innovation on trade in agricultural and food products. These studies such as for example (Dosi, Pavitt and Soete, 1990) treat the food processing sector most of the time at a very high aggregation level (i.e. as one sector) and use data from the mid-seventies and find no statistical significant impact of innovation on trade flows. What is needed are studies that investigate the relation between food products and trade on a more desaggregated level and for a recent period. To our knowledge there are no studies that tested or estimated some implications of the new growth theories. This is no surprise because the theory is very new and difficult to test.

4. IDENTIFYING USEFUL RESEARCH AREAS

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The literature review on agricultural trade analysis shows that most economic analysis focuses on basic agricultural commodities and rests on traditional theoretical insights of comparative advantage, assuming perfect competitive markets on which goods are homogeneous and produced under a technology of constant returns to scale. It is recognized that the importance of processed agricultural products, manufactured foods and other high-value products in international trade is increasing. The economic analysis of trade in these products request different approaches than those traditional ones used for analysing trade in basic agricultural products. Only recently some research efforts have been spent on a possible application of concepts of imperfect competition and increasing returns to scale to agricultural trade and trade policy analysis focusing on products with increasing level of value added.

Now we have seen what approaches have been followed in the literature on agricultural trade we will come up with a confrontation of what we assess important features as determinants of trade in the three agricultural groups of products we identified in section 2 (see figure 1.3) on the one hand and what according to the literature reviewed (in section 3) has been used in agricultural trade analysis on the other. The confrontation is presented in figure 4.1. Main entrances of this table are the three groups of agricultural products (columns) as we classified them in section 2 and the central mechanisms of trade according to trade theories (rows). For every product classified we take from table 1 the assessment on the importance of the features as determinants of international trade. Then we evaluate the attention paid to each determinant for each of the group of products by research efforts. This latter assessment is induced by the review of literature on agricultural trade (policy) analysis as reported in section 3.

In explaining trade flows in undifferentiated primary products research attention has been focusing on the core elements of the traditional trade theories, i.e. natural resources and factor endowments, assuming a market structure with perfect competition. Physical infrastructure and process innovations are also considered to receive much attention as both features are strongly related to natural resources as well as to factor endowments and to the cost of production which is considered the major driving force of trade in these group of products. Much research effort is spent on the impact of domestic government policies oriented to farm products on international trade in these products. It appears that in the analysis of trade in differentiated primary products the research attention is focusing on the same elements as with respect to the trade analysis of undifferentiated primary products. However, features like differentiated goods and imperfect competition - which are considered to be of

more importance as determinants of international trade in these group of products - get more attention from the research community.

Based on what we have learned from the literature review, we conclude that research attention on trade analysis of processed food products has been low so far; there is little work done yet. Therefore, for nearly all features of products, markets and countries identified, the score of research efforts is low or moderate at the highest. And this is quite understandable because the concepts to investigate imperfect competition, product differentiation, increasing returns to scale and other features influencing (imperfect) market structures are rather new. Furthermore, these concepts require other data and model structures than those developed along the neo-classical lines. The latter approach is still the mainstream in agricultural trade analysis. Its limitations are known and at the same time widely accepted mainly because the alternative approaches are not yet considered to be adequately applicable to agricultural trade analysis.

Fruitful areas for further research are those fields where features are assessed to be of importance but research attention has been low. In the table these fields are identified as grey areas. It is not surprising that most areas are in the column of the processed food products. We consider these fields fruitful for further research not only from an academic point of view, but also because the development of more expertise in these areas would expand and improve the Institute's capability to serve its clients on trade issues of gaining importance. Future research efforts on agricultural trade analysis should therefore be directed towards the group of differentiated and processed products and focus on the features identified as important determinants of trade in these products. Furthermore, the confrontation presented in the table reveals that there are also features important for explaining trade in primary commodities which did not get the research attention they deserved. This refers to knowledge spillovers (for undifferentiated primary products) and knowledge infrastructure (for undifferentiated and differentiated primary products). Moreover, we notice that in explaining trade in differentiated primary products more research attention should be focused on the feature of differentiated goods and product innovations.

The direction for future research on the field of trade in agricultural and food products came out clearly from the foregoing analysis. The features of agricultural trade flows and patterns are changing while research has not been able to cover the questions related to these changes. This is because the field is rather new, theoretically as well as the application of new concepts to agriculture. We apply for more research attention focusing on the processed food products, using concepts from the new trade theories. This recommendation is much in line with what is expressed at recent conferences and seminars on the topic of international agricultural trade and competitiveness. The following example may act as an illustration of these thoughts on research needs in the field of trade.

In its comments to papers presented at the IATRC conference on 'Competitiveness in international food markets', Bullock presents his opinion on how research resources should be allocated in order to better understand what he

calls 'new realities of world trade in food products' (1994: 319). He distinguishes between an 'old' and a 'new research paradigm' of agricultural trade analysis. The old research paradigm is aimed at improving the efficiency of the production of basic agricultural commodities, Bullock states. Research efforts are focused on exposing trade distortions and showing the negative consequences of it. Furthermore, the traditional agricultural research views the world from a commodity orientation, not included processed food products, Bullock claims. Research efforts are related to measuring and comparing labour productivity, capital productivity etcetera. The new paradigm directs the researcher's view to trade in food products, driven mainly by demand, not supply and the recognition that not countries do compete but competition for trade is on product and/service level. According to Bullock, the research agenda on trade would be more orientated towards specific products in specified markets. This implies, as we understand it, focusing of future research in agricultural trade analysis on differentiated, processed agri- and food products and on markets which are clearly and precisely defined.

Features of products, markets and countries	Importance of features as determinants of international trade and the research attention devoted to these features as determinant of trade					
	Undifferentiated Primary Commodities		Differentiated Primary Products		Processed Food Products	
	Impor-tance	Research Attention	Importance	Research Attention	Impor-tance	Research Attention
Natural Resources	Great	High	Some	High	Little	Low
Production factors:						
Factor endowments (land, labour, capital)	Great	High	Some	High	Little	Low
Human capital/knowledge	Some	Moderate	Some	Moderate	High	Low
Technology:						
Internal Economies of Scale	Little	Low	Little	Low	Great	Moderate
External Economies of Scale	Some	Low	Some	Low	Some	Low
Technology differs between countries	Little	Low	Some	Low	Great	Low
Process innovations	Great	High	Some	Moderate	Some	Moderate
Product innovations	Little	Low	Great/Some	Low	Great	Low
Knowledge spillovers	Great	Low	Some	Low	Some	Low
Consumer preferences						
Income elasticity	Great	High	Great	High	Great	Moderate
Market structure						
Perfect competition	Great	High	Some	Moderate	Little	Low
Imperfect competition	Some	Low	Some	Moderate	Great	Low
Government						
Policies (e.g. trade policy)	Great	High	Great	Moderate	Great	Low
Physical infrastructure	Great	High	Some	Moderate	Great	Low
Knowledge infrastructure	Great	Low	Great	Low	Great	Low

Figure 4.1   The importance of determinants of trade and research attention devoted to these factors

5. CONCLUSIONS

The observation of changing trade characteristics in agriculture and food products, private business concentration and active government policy suggest that international agricultural trade analysis implies investigating market structures other than the competitive mode. From the description of circumstances and characteristics in section 2, the thought was already expressed that the nature of international trade in agricultural and food products is increasingly characterized by imperfect competition. There is a tendency of concentration within the processing and trading (wholesale and retail) activities in the field of agriculture and food. Furthermore, the international traded commodities are of a differentiated nature, resulting in intra-industry type of trade. Assumptions on the competitive structure, therefore, appear to obscure the real nature of the trading process. This has important consequences for the use of trade models in explaining agricultural trade flows. Furthermore, agricultural policies protecting the sector are the norm rather than the exception amongst the industrialized countries. These policies are implemented in ways which affect countries' trading positions and international trade flows. Therefore, agricultural trade analysis also should focus attention towards the impact of government policy on international trade. This element may be stressed even because the agricultural policies of important players at the international markets (USA and EU) are changing in the context of present (and future) GATT/WTO trade agreements with possible major impacts on world trade flows in agriltural and food products in due time.

Our concept of agricultural trade analysis is based on the match of the important characteristics of the agricultural and food products with trade theories. In many cases, determinants of trade are not covered by one trade theory as trade theories focus on one determinant or on a few interrelated determinants. Still, we expect the traditional theories to be well suited for explaining trade in undifferentiated products while the analysis of trade in differentiated and processed food products are expected to draw on modern trade theories. An assessment of the relative importance of the features of products, markets and countries identified helps to decide which theoretical approach is best suited in the trade analysis. This assessment may be based on empirical research.

The review of literature shows that most agricultural trade analysis focuses on basic agricultural commodities and rests on traditional theoretical insights of comparative advantage, assuming perfect competitive markets on which goods are homogeneous and produced under a technology of constant returns to scale. Only recently some research efforts have been spent on a possible application of concepts of imperfect competition and increasing returns to scale to trade in differentiated agricultural products and trade policy analysis

while the increasing importance of processed agricultural products, manufactured foods and other high-value products in international trade is recognized.

We consider fruitful areas for further research those fields where features are assessed to be of importance but research attention has been low. Not surprisingly we conclude that future research efforts on agricultural trade analysis should be directed more towards the group of differentiated and processed products and focus on the features identified as important determinants of trade in these products. Besides this, it is noted that the research attention towards knowledge (spillovers and infrastructure) is less than desired for undifferentiated and differentiated primary products too. Further research on measuring the importance of features identified as determinants in trade of differentiated agricultural and processed food products would be fruitful not only from an academic point of view but would also be of interest to the Institute to better serve its clients on trade issues.

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