AN INTEGRATED PERSPECTIVE ON AGRICULTURAL TRADE

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Although the agricultural output increased in the recent two decades by 62.9 percent and amounted to US$ 2,217 billion in 2010 (constant 2004-2006 US$) (FAOSTAT, 2012), the growth in global agricultural production slowed down. This does not, however, apply to trade in agricultural commodities, which more than tripled in the same period, so that the exports reached US$ 946.8 billion in 2009 (in current US$). But due to limitations of the common trade theories, like the concept of comparative advantage (Ricardo, 1817) and the factor proportions theorem (Heckscher, 1919; Ohlin, 1933), the attempts of explaining this recent development remain unsatisfactory.

Given the limitations of the traditional trade theories, we constructed an integrated empirical model for the study of trade patterns. Particularly the North-South and North-North trade in agricultural commodities need a new analytical framework. We propose a combination of elements from the demand-oriented trade theory (Burenstam Linder, 1961) and the gravity model. Burenstam Linder wrote that “The more similar the demand structures of two countries, the more intensive, potentially, is the trade between these two countries” (1961, 94). Accordingly, we introduced the variable of similar demand structures, which we define not as similar levels of income (as Burenstam Linder did), but as levels of per capita consumption of agricultural commodities. Further, following Burenstam Linder’s theory, only potential trade may be investigated. That is why we added transaction costs in order to be able to analyze the actual trade, too.

Yet, trade is not merely determined by similar demand structures and transaction costs. Thus, building on the assumptions of the gravity model, we claim that also production ability and consumption matter. Furthermore, we supplemented our concept with socio-cultural aspects and specifics of regional trade. The so obtained new empirical trade model allows the analysis of both import and export trade. In order to test it, we developed a panel dataset, spanning the period 2002-2008 and covering aggregated agricultural trade of 102 countries with 130 partners, and introduced time and cross-country variables to control our findings. The panel dataset was developed on the basis of trade and production data from FAOSTAT (2012), while distance and dummy variables are from CEPII (Mayer and Zignago, 2011), and time and regional dummies from CIA (2012). Four different models – for import and export trade, with and without zero-trade events – were estimated, applying PPML estimation procedure.
(Santos Silva and Tenreyro, 2006) and utilizing RESET-, LINK- and VIF-tests in order to check for the adequacy of the estimation procedure, variables and model specification.

Both, the import and export trade models yield highly significant estimators, with \( p \)-Value < 0.05, and have a strong explanatory power, as \( R \)-squared > 0.40. Also, all used control variables have the expected signs. The statistical tests confirm that the model was properly specified, the correct estimation method was applied, and multicollinearity did not occur. The results point to existence of a positive relationship between the similarity of the agricultural demand structures of home and foreign markets and the intensity of trade relations between these countries. Moreover, production and consumption are major drivers of agricultural trade, and transaction costs negatively affect imports and exports. The new concept of similar demand structures yields a less pronounced effect than in traditional estimations (e.g., Hallak, 2010), and provides a suitable tool for the analysis of agricultural trade, particularly North-North trade. Besides, we estimated equally strong market effects as in Hoekman and Nicita (2011) and Santos Silva and Tenreyro (2006), but our variables have at the same time a better theoretical foundation. The impact of the geographical distance as a proxy of transaction costs is slightly above traditional estimates (Overman et al., 2003), which is not of disadvantage considering that we used the more sophisticated distance measure by Mayer and Zignago (2011).

Concluding, we hope to have provided a tool for empirical trade research rather than for verification of trade theory. Thus, with the integrated analytical framework we want to propose a new approach for the study of agricultural trade. In particular, the model makes it possible to simultaneously consider North-North and North-South trade patterns. Such results are possible as we compared the levels of per capita consumption of agricultural commodities instead of the income levels. The idea of linking the elements from the demand-oriented theory by Burenstam Linder with the gravity model lets us analyze trade from a production and consumption perspective at the same time. A further possible application of the model is the analysis of the patterns of trade for disaggregated flows. It allows detailed studying of one-commodity markets and, thus, provides well-founded policy recommendations. There are also some limitations of the model. Aspects like the role of trade agreements, relative prices, tariffs and other trade barriers, or the case of differentiated goods are not considered in the proposed form of our model. Still, it can be easily adapted to these requirements and be used for studying a wide range of trade characteristics, from foreign direct investment mobility in agricultural sectors to food commodity trade, focusing e.g. on impacts of preferential trade agreements.
References


**An Integrated Perspective on Agricultural Trade**

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### Introduction

- Despite the reduced dynamics of growth in global agricultural production since 1990, its output increased by 62.9 percent and amounted in 2010 to US$ 2,217 billion (constant 2004-2006 US$) (FAO 2012).
- Notably, the value of agricultural trade more than tripled in the same period, leading to roughly US$ 946.8 billion (in current US$) of agricultural exports in 2009. The strong annual growth in trade in the 1990s (+ 3.5 percent on average) and even more vigorous growth in the 2000s (+ 9.0 percent respectively), led to higher degrees of market integration and specialisation.
- Traditionally, two major approaches explaining trade patterns between entities might be applied to analyse these recent developments: the concept of comparative advantage (Ricardo, 1817) and the factor proportions theorem (Heckscher, 1919; Ohlin, 1933). While Ricardo’s approach is not very decisive when explaining trade in the long-run, the H-O model is not able to catch the characteristics of North-North trade.
- Given the numerous limitations of the common trade theories, we constructed an integrated model for the study of trade patterns. Particularly the North-South and North-North trade in agricultural commodities needs a new analytical framework. Thus, we approached our research, first, establishing a study framework for contemporaneous analysis of North-South and North-North trade; and second, determining the role of transaction costs and similar demand structures in this context.

### Analytical Framework, Data and Methods

- We propose a solution by combining the demand-oriented trade theory (Buremst Linder, 1961) and the gravity model.
- The demand-oriented trade theory: ‘The more similar the demand structures of two countries, the more intensive, potentially, is the trade between these two countries’ (Buremst Linder, 1961, p. 94).
- The gravity model of international trade: Trade relations between two countries are determined by their sizes and the distance between them.
- We define similar demand structures (SD) not as similar levels of income, but as levels of per capita consumption of agricultural commodities (CN) and (CN).
- Following Linder’s theory, only potential trade (PTij) may be investigated. Through the introduction of transaction costs (TCij), also the actual trade (ATij) can be analysed.

#### FIGURE 1
**Demand structure and potential trade**

![Diagram showing demand structure and potential trade](https://example.com/diagram1.png)

#### Equations

**Eq. 1:**
\[ AT_{ij} = \alpha \left( \frac{1}{SD_{ij}^2} \right) T_{C_{ij}} \]

**Building on the assumptions of the gravity model, we claim that trade is not solely determined by similar demand structures and transaction costs, but also by production ability (P) and consumption (C) or (C).**

- This is supplemented by socio-cultural aspects and specifics of regional trade (zij).
- The model constructed this way is applicable for the study of both import (ITij) and export (ETij) trade:

**Eq. 2:**
\[ IT_{ij} = \beta SD_{ij}^2 C_{ij} P_{ij} T_{C_{ij}} Z_{ij} \]

**Eq. 3:**
\[ ET_{ij} = \delta SD_{ij}^2 P_{ij} C_{ij} T_{C_{ij}} Z_{ij} \]

- To test the model, a panel dataset was developed, spanning the period 2002-2008 and covering aggregated agricultural trade of 102 countries with 130 partners, and controlled by introducing time and cross-country variables.
- Data for trade and production was obtained from the FAOSTAT database; distance and dummy variables from CEPII database (Mayer and Zignago, 2011); time and regional dummies were constructed on the basis of CIA data.
- Two different models were estimated, applying PMML estimation procedure (Santos Silva and Tenreyro, 2006) and utilising RESET, LINK- and VIF-tests in order to check for the adequacy of the estimation procedure, variables and model specification.

### Results and Discussion

- The import (Eq. 2) and export (Eq. 3) models have a strong explanatory power (R-squared > 0.40) and yield highly significant estimators (p-Value < 0.05).
- All control variables have the expected signs. The statistical tests confirm that the model was properly specified, the correct estimation method applied, and there is no multicollinearity.
- The less similar the agricultural demand structures of home and foreign markets are, the smaller the trade relations between these countries will be.
- Production and consumption are the major drivers of agricultural trade, while transaction costs negatively affect imports and exports.

#### TABLE 1
**Estimation statistics and test results**

<table>
<thead>
<tr>
<th>Estimation Statistic</th>
<th>Import Trade</th>
<th>Export Trade</th>
<th>Import Trade</th>
<th>Export Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>91,157</td>
<td>58,459</td>
<td>91,157</td>
<td>58,459</td>
</tr>
<tr>
<td>OLS</td>
<td>Mean</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>F-value</td>
<td>Significant</td>
<td>significant</td>
<td>significant</td>
<td>significant</td>
</tr>
</tbody>
</table>

**Note:** Authors’ calculations. All statistics are based on the results of the PMML estimations. Original statistics can be obtained upon request from the authors.

**SD** yields a less pronounced effect than in traditional estimations (e.g., Hallak, 2010) and provides a better tool for the analysis of agricultural trade, particularly North-North trade.
- We estimated equally strong market effects as in Hoekman and Nica (2011) and Santos Silva and Tenreyro (2006), having at the same time a better theoretical foundation.
- Dij as a proxy of transaction costs is slightly above traditional estimates (Overman et al., 2003).

### Conclusions

- The integrated analytical framework offers a new approach for the study of agricultural trade. In particular, the model makes it possible to contemporaneously consider North-North and North-South trade patterns.
- It also catches the patterns of trade for disaggregated flows (one-commodity markets).
- Linking the elements of demand-oriented trade theory (Linder) with the gravity model enables the analysis of trade from both a production and consumption perspective.
- Limitations: The role of trade agreements, differentiated goods, relative prices, tariffs and other trade barriers.

### References

